FLYING

AND POPULAR AVIATION

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CIVILIAN AVIATION The Story of CAA

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FEBRUARY

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City..... State.....

ONE of the deadliest weapons the United States now must combat is the human tongue. Talkative aviation industry workers, especially, can do this country more damage in saloons than can enemy bombers over our cities. America's enemies are viciously clever. They know that it is a human failing to talk about something in which you are interested. People in *their* countries who succumb to this luxury face the headsman or firing squad.

American aviation people must keep their mouths *shut*. Enemy agents are as interested in knowing the horsepower of the engine in that new fighter as you are in telling a friend about it. To carelessly talk about the size of the tires on a new bomber might well result in the deaths of many Americans and the destruction of vital resources. To the alert spy, the size of a tire indicates, within certain general limits, the size of the airplane. Another carelessly-dropped word about the size engines in the same airplane narrows down the spy's margin of guesswork. A few more "innocent" details of that nature usually finds the enemy with an amazingly accurate guess as to the size, weight and performance of our "secret" airplane.

DON'T casually drop the remark to a friend at lunch that you worked on three ships this morning. Enemy agents can easily find out what department you work in, the type of plane you worked on, the time you started work and the time you went to lunch—and, subsequently, another vital fact concerning the production rate of your factory.

DON'T happen to mention, during a friendly poker game, that a certain airplane you know of carries 4,212 gallons of gasoline. Everyone knows that gasoline weighs six pounds per gallon. An enemy agent then would know that that airplane carried a fuel load of 25,272 pounds; an aeronautical engineer, knowing the fairly constant ratio between fuel load and payload, could hazard a pretty good guess as to the size load that plane could carry.

DON'T boast to some air-minded friend that the Acme B-92Q did 419 m.p.h. at 29,000 feet during tests with a full load the other day. If you do, chances are you will have unwittingly murdered 20 or 30 American flyers.

So, if you are an American aviation worker or are connected with the aviation industry in any way, *shut up!* If you don't you will be killing fellow Americans as surely as if you pulled the trigger yourself.

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FLYING
AND POPULAR AVIATION
Trade Mark Registered

Volume XXX Number 2

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Cover Photograph by Hans Groenhoff

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ZIFF-DAVIS PUBLISHING COMPANY
Editorial Offices: 540 N. Michigan Ave., Chicago, Ill.
Member of the Audit Bureau of Circulations

FLYING AND POPULAR AVIATION is published monthly by Ziff-Davis Publishing Company at 540 N. Michigan Ave., Chicago, Ill. William B. Ziff, Publisher; B. G. Davis, Editor; Max Karant, M.I.Ae. S., Managing Editor; George Berner, Advertising Manager; Herman R. Bollin, Art Director. Circulation Manager, H. G. Strong. New York Advertising Office, 270 Madison Ave. West Coast Advertising Representative, William L. Pinney, 416 W. Eighth St., Los Angeles, Cal. Washington Bureau, Occidental Hotel, Lieut. Col. Harold E. Hartney, Manager. SUBSCRIPTION RATES: In U. S., $3.00 per year, single copies 25 cents; in South and Central America and U. S. Possessions, $3.00 per year; in Canada, $3.50 per year, single copies 30 cents; in British Empire, $4.00 per year. All other foreign countries, $6.00 per year. Subscribers should allow two weeks for change of address. Address all subscription letters to the Director of Circulation, 540 N. Michigan Ave., Chicago. Entered as second class matter, July 16, 1940, at the Post Office, Chicago, Illinois, under the act of March 3, 1879. Entered as second class matter at the Post Office Department, Ottawa, Canada. Contributors should retain copy of contributions. All submitted material must contain return postage. Contributions will be handled with reasonable care, but this magazine assumes no responsibility for their safety. Accepted material is subject to what ever adaptations and revisions are necessary to meet requirements. Payment will be made at our current rates upon acceptance and, unless otherwise specified by the contributor, all photographs and drawings will be considered as part of the manuscript in making payment.

You Need LONG-RANGE TRAINING TO REACH Your OBJECTIVE

Aviation has JOBS for thousands, but CAREERS only for trained men!

The National emergency has enabled thousands of men to make a short hop into temporary, single-phase jobs in the aircraft industry through cheap "quickie" courses. BUT—just as America's Air Force depends on its long-range bombers to reach distant objectives, aviation's leaders will only entrust responsible supervisory positions to men with the long-range training to reach any objective to which they may be assigned. The executives who have made aviation THEIR career know that the value of each man is governed by two factors: his serious purpose in selecting aviation as his life work, and THE ABILITY AND EXPERIENCE OF THOSE WHO TRAIN HIM FOR THAT CAREER. They know that Curtiss-Wright Technical Institute graduates are—and for many years have been—thoroughly qualified to fill the industry's most exacting requirements.

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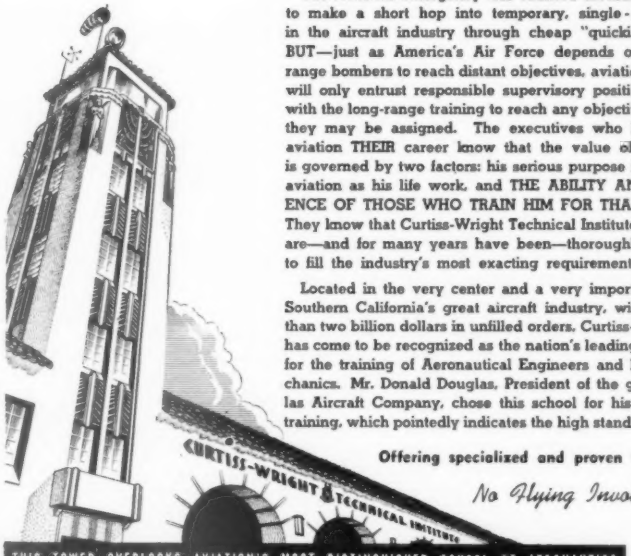

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Letters

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Sirs:

. . . It was a splendid edition.

J. H. TOWERS,
Rear Admiral, U.S.N.,
Chief Bureau of Aeronautics.
Washington, D. C.

———

Sirs:

. . . It is an excellent issue and I shall find it most valuable.

H. N. THORNTON,
Air Commodore,
Air Attache,
British Embassy
Washington, D. C.

———

Sirs:

. . . I am very glad, indeed, to have such an excellent reference book on the subject of U.S. Naval air power and I am sure I shall find it of equal value to the U.S. Army Air Forces issue.

HALIFAX,
British Ambassador
to the United States.
Washington, D. C.

———

Sirs:

. . . Again, you have scored with an outstanding piece of publishing and I want to congratulate you upon this fine issue.

ROGER C. LOEW,
Klau-Van Pietersom-Dunlap
Associates.
Milwaukee, Wis.

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Sirs:

. . . I have received a specially bound copy of our Naval Forces issue of FLYING AND POPULAR AVIATION. I am delighted to have it for my bookshelf, and want to thank you not only on my own behalf for your thoughtfulness but also to express my appreciation for putting such a splendid volume before the public.

H. R. STARK,
Admiral, U.S. Navy,
Chief of Naval Operations.
Washington, D. C.

———

Sirs:

. . . The beautiful job you did in covering the U.S. Naval air power so completely . . at such an appropriate time, certainly deserves the thanks of every one even vaguely interested in what is happening today. It is a beautiful job and I want to congratulate you on it.

A. T. HAPKE,
Bell Aircraft Corporation.
Buffalo, N. Y.

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Sirs:

. . . I am sure it would please you to know that I find constant use for your special U.S. Army issue . . . It represents without doubt one of the outstanding achievements in aeronautical publications to date. I feel certain your new issue for the Navy will be of equal importance, though it is hard to conceive of anything being more perfect than the Army issue.

ROGER WOLFE KAHN.
New York, N. Y.

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Sirs:

. . . I think that you have done a splendid job and have produced a book of lasting value.

FORREST SHERMAN,
Commander, U.S. Navy,
Navy Department.
Washington, D. C.

———

Sirs:

. . . I think we can all be proud of this issue and I wish it were possible for every American family to have a copy.

H. T. ORVILLE,
Lieutenant Commander,
Navy Department,
Bureau of Aeronautics.
Washington, D. C.

———

Sirs:

. . . I want to extend my sincere compliments on the able manner you have presented to the public in this issue, the timely information contained in the excellent articles therein.

R. R. WAESCHE,
Rear Admiral,
U.S. Coast Guard, Commandant.
Washington, D. C.

———

Sirs:

. . . I congratulate you and your associates on this fine book.

LEONARD K. FIRESTONE,
Firestone Aviation Products Co.
Akron, O.

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Sirs:

. . . The issue is one of which you may well be proud, and should aid greatly in acquainting Americans with Naval aviation.

RALPH DAVISON,
Navy Department,
Bureau of Aeronautics.
Washington, D. C.

———

Sirs:

. . . This is just as attractive as the Army issue and certainly presents the Naval air arm in a very complete way.

JOHN P. GATY,
Vice President-General Manager,
Beech Aircraft Corporation.
Wichita, Kan.

———

Sirs:

. . . The U.S. Naval air power issue of FLYING AND POPULAR AVIATION . . . will always be a prime source of reference for Naval Aviation in the aeronautical

(*Continued on page* 120)

Are You Thinking About Getting Into Aviation? --Then don't fail to read this letter---

July 25, 1941

Dear Sir:

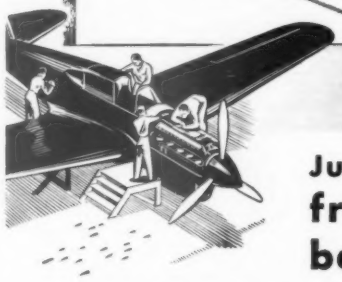
I've been employed here at Curtiss-Wright as an inspector in fuselage and my work takes me from the beginning of the skeleton of the ship up to the assembly of the instruments. I'm the only inspector, less than a lead man, that does this. Yes, I'm bragging because it is in a way something to brag about. Doing all these different inspections, making out salvages, reading and checking dispositions, checking parts with the blue prints, make me realize how much I learned out at Aero I.T.I. I've never regretted spending the money I did for my training because it's the future that I'm looking at.

I suppose you wonder why I'm writing you this. Well it's because I've never forgotten how well I was treated out there and the least I can do is to show you how much I'm getting from your thorough training. I'm sure that I haven't received the full benefits from it yet and I'm looking forward to the day that I will. I remain, an old student,

Your friend,
John Lepley

The Writer

—is John Lepley, a young man from Lewistown, Pa., who attended Aero Industries Technical Institute to prepare for a career in aircraft manufacturing, and was graduated from his course in January, 1941. He stepped directly into aircraft production and had been employed only 6 months at the time he wrote this letter. It is a tribute to both the man and his training that he was able to win such important responsibility in so short a time.



"makes me realize how much I learned out at Aero I.T.I."

"it's the future that I'm looking at"

"I'm sure that I haven't received the full benefits from it yet"

Just one of many such letters from Aero I.T.I. trained men who have been rewarded *the way YOU want to be*

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YOU can follow in the footsteps of John Lepley... and when you do, you follow the lead of not just ONE man, but of 3,416 Aero I.T.I. graduates now making good with 137 firms in all divisions of Aviation. Aircraft production, airline maintenance, or aeronautical engineering... whichever of these swiftly expanding branches of the industry you wish to enter, at Aero I.T.I. you will get true career training.

Aero I.T.I. will NOT give you short, sketchy training for just a temporary aircraft job. Bring to this large, splendidly equipped school the same plan for YOUR future that John Lepley is achieving so successfully, and Aero I.T.I. will give you the broad, thorough training it takes to STAY in Aviation...to merit promotion...and to win success.

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Aero Industries Technical Institute, 5255 W. San Fernando, Los Angeles, Calif.

Please send information on Aero I.T.I. training for Aviation careers. I am interested in the following branch of Aviation: ☐ Aircraft Mechanics; ☐ Aeronautical Engineering; ☐ Undecided, please send more information. Years High School: ☐ 1, ☐ 2, ☐ 3, ☐ 4. Years College (Liberal Arts): ☐ 1, ☐ 2, ☐ 3, ☐ 4. Years Engineering College: ☐ 1, ☐ 2, ☐ 3, ☐ 4.

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The Birdmen's Perch

This month marks a milestone in the history of the Birdmen's Perch. For the first time, we have gotten a letter from one of our readers who admits that one of our problems was definitely too much for him!

Major Al Williams, alias, "Tattered Wing Tips,"
Gulf Aviation Products Manager, Gulf Bldg., Pittsburgh, Pa.

THE MAN WHO YELLED "UNCLE"

Dear Major Williams:

After spending five hours, thirty-two minutes, twenty-one seconds in attempting to solve this problem, I feel fairly certain either that you are pulling our collective leg, or that I have greatly overestimated my puzzle-solving ability. I have presented your "Twister" to all of my friends and they in turn to their friends in its original form, and our unanimous decision is that the problem is not workable.

As you have probably guessed by now, this all leads up to the fact that I GIVE UP, and would greatly appreciate your sending me the solution to this problem.

Unhappily yours,
Richard L. Sullivan
Kansas City, Missouri

DID YOU SAY JUMP!

We hope you didn't miss the story about the student flier who was soaring over Brooklyn with his instructor the other day. The instructor yelled back something to his student and pointed downward, in the direction of Canarsie. The next thing the instructor knew, his student was gone and, far below, a parachute was opening up. The student had thought he said "JUMP!"

Now the way this story ties in with Gulfpride Oil is this: when we say "Jump" to the carbon- and sludge-makers that exist in all oils, we *mean* it. And we don't say it just once, we say it a couple of times (by means of conventional refining methods and by the Gulf famous Alchlor Process). The net of it is, that by the time you put Gulfpride in your airplane engine, *more* of the trouble-causing elements in oil have been taken out of Gulfpride. Result: A sweet-running, well-lubricated engine at all times!

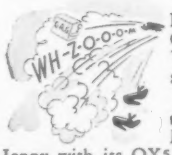
THIS MONTH'S BRAIN TWISTER

Here's one from Mr. Cecil E. Pearce, of Tacoma, Wash., who likes the problems we've been running lately.

There were two aviators who had a certain number of gallons in their gas tanks. Aviator No. 1 said to No. 2, "You give me half of your gas, and I'll then have twice as much as you will then have." Aviator No. 2 said, "No, you give me half of your gas, and I'll then have as much as you will then have."

How much gas was in each tank at the beginning?

THIS MONTH'S WHOPPER



Dear Major:

Darn you and your old Gulf Aviation Gasoline! You sure have me in a sweet predicament.

It all happened like this about two days ago. I started out in my 1917 Jenny with its OX5 motor, to take a hop around the field.

Now I want you to understand that this plane is in pretty good condition even if it is kind of old. Of course I've had to fix it up a little here and there. I've had to tie up the controls with bailing wire and patch the wings with an old pair of overalls, and I thought it wouldn't hurt to try a little of this G. A. G. to give her a little extra pep.

When I spun the propeller, the engine took hold on the first revolution and I barely had time to get into the cockpit. She took off like a scalded cat, and before I knew it, I was up to ten thousand feet.

Well, I should have known it was too good to last, because that gasoline was just too strong. The crank shaft twisted in two and the vibration tore the engine clear out of the plane.

It just happened that an eagle was flying along under me and some of that G. A. G. squirted into his mouth. He liked it so well that he must have decided to take it home to his nest. He flew around in front, grabbed

the front of the plane with his claws, and towed me along at a speed that old Jenny had never seen before.

We finally arrived on the top of a peak, and I climbed out of the cockpit to take a look around. Well, here I am on Devils Tower (these eagles build their nests in the darndest places).

It would be awfully lonesome up here if it weren't for some parachutist who happened to be here when I arrived. We play tick-tack-toe all day, which keeps my mind off of my troubles.

I am dropping this letter over a ledge in hopes that somebody will pick it up. Please tell me how I am going to get down off of here, since you are responsible for my predicament.

Yours hopefully,
Joyce Olson, San Diego, California

P. S. There's no hope of getting help from the eagle, because all of the eagles are over there having a party on that G. A. G.

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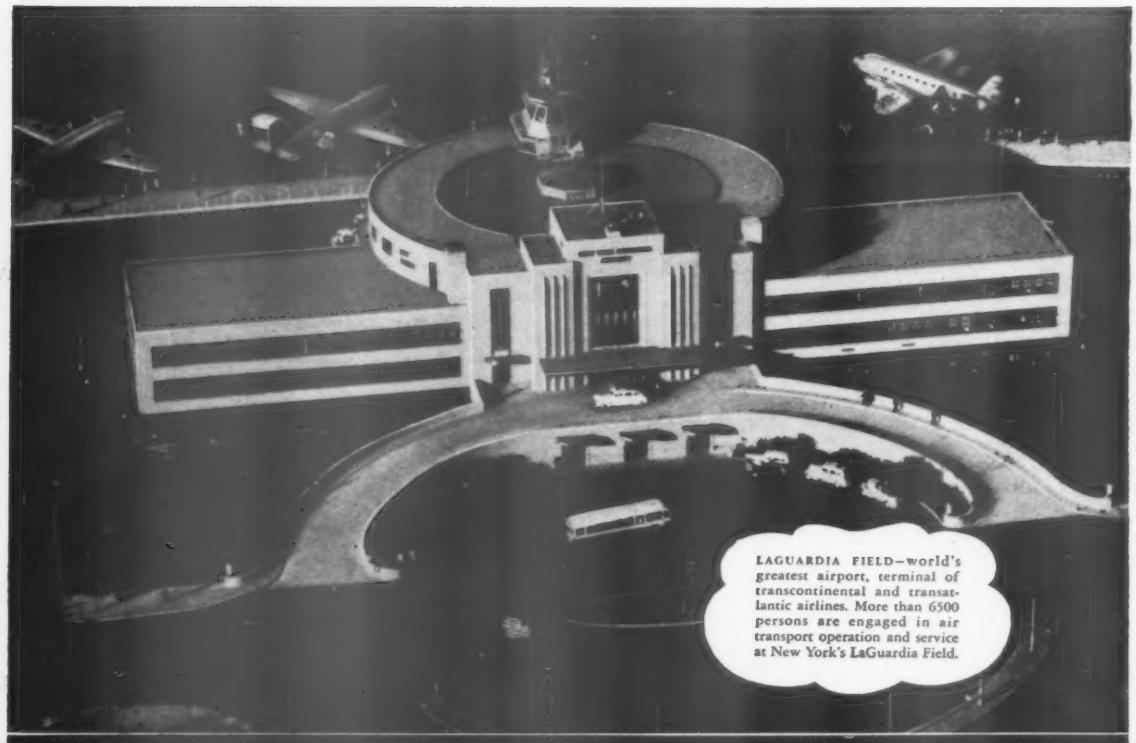
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POLLY SMITH PHOTO

A Call for Volunteers

Some are in the air, ferrying bombers across the ocean. Others are in training, learning how to fly. Some are on the ground, keeping planes in good repair. Others are in aircraft shops, repairing instruments with delicate precision. Some are at drafting boards, designing planes of tomorrow. Others are in aircraft factories, rolling planes off the line. *All* are in the aviation industry, serving their country with skilled knowledge.

The men in the aviation industry comprise the largest army in the nation; yet, not one was conscripted. All are volunteers. Each man believed that he could serve his country best by developing his natural talents. Some became fliers; others, aircraft mechanics. Some became instrument technicians; others, designers. *All* became an integral part of aviation's vast army of skilled workers.

Aviation is one of the most vital phases of the national defense program; yet, there is a definite shortage of skilled workers. You can help fill this shortage by training for one of these essential jobs at an accredited aviation school. You can do your part by answering this call for volunteers.

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PA-2-42

Flight over the Atlantic, daring feat of yesterday, becomes routine as hundreds of military landplanes make the 2,200 mile hop to aid RAF.

Bombers Across

by Capt. EDGAR J. WYNN

EVERY day we read in the newspapers of the exploits of some fighter or bomber pilot over Germany or England. We thrill to the picture of some young sergeant-pilot being presented with the DFC.

But another equally important—and dangerous—job is being performed every day, a job that is less spectacular than that of the fighter pilot and about which the general public knows little or nothing. That job is ferrying American-made bombers across the North Atlantic to Great Britain.

Not long ago a flight across the Atlantic called for a parade, a shower of ticker tape and the key to the city. For more than a year now, a small band of pilots has been winging its way back and forth over 2,200 miles of ocean, through all kinds of weather, depending upon their own skill and initiative. They are flying landplanes never intended to fly across entire oceans. But they are getting them there without a hitch.

These men are unknown to the public. Who are they? Why are they doing this job? What are their thoughts on those long sleepless nights, high above mid-ocean? Do they fly alone or with a crew? For the first time, war censorship has been lifted to allow these and many other questions to be answered. The pilots and crews themselves are pledged to secrecy.

After serving in the RCAF for more than a year Captain Wynn, an American pilot, resigned his commission a few months ago. Previous to that time he was in charge of training every American who joined the Canadian Atlantic Ferry Command. Following this tour of duty, he made several trips across as a pilot of U. S.-built Britain-bound bombers. One of these journeys he describes in detail in this article. He is at present flying for Pan American Airways and is stationed in Miami, Fla.—Ed.

Heading the Royal Air Force Ferry Command (the present title of the organization) is a veteran Royal Air Force pilot, Air Chief Marshal Sir Frederick Bowhill. A veteran of thousands of hours of service flying, including command of a coastal patrol unit in the present war, he has the respect of every man in the organization.

The men performing this job seven days a week, through all kinds of weather, come from all parts of the world. Among them are some of the world's best pilots. There is the winner of the famed London-to-Australia race, an Englishman; a famous Canadian Arctic flyer, an American of round-the-world fame, a Dutch airline pilot and another from Egypt. Here and there among them one sees the dusty blue uniform of the Royal Air Force, with a DFC a common sight. All are tops in their profession. Besides being expert pilots, they must have a good working knowledge of navigation, meteorology, airplanes, engines, radio and the thousand little details which mean the difference between getting an expensive, much-needed bomber to the fighting forces in the United Kingdom—or oblivion in the trackless waters of the Atlantic Ocean.

The first requisite for a pilot applying for the job is that he be an instrument pilot with multi-engined experience. The

Civilians and military men, both Canadian and American, comprise transatlantic ferry crews. This group is discussing pre-flight weather data. Man second from right wears U. S. Navy aviation wings in coat lapel.

majority of our flying personnel are Americans. This, of course, is due to the fact that Canadian and English pilots are, for the most part, already in the air forces of their own countries. So most ferrying pilots come from the ranks of the airlines, or are former Army or Navy pilots with experience on large multi-engined equipment. Flying the Atlantic is no job for a novice.

When the new pilot's credentials have been thoroughly investigated and he has emerged successfully from an interview with the superintendent of flight training, he is ready to start his preliminary training. His first week is spent in the classroom studying navigation. Most of it he probably already knows, although the brushing-up brings to light many points he has forgotten or is not too clear on. From dead reckoning at which he is expected to be proficient from the start, he progresses to radio navigation and use of the flight computer. Many things are new to him. Unless he has been a Naval or boat pilot he probably has not used mercator charts. He must learn to think in knots, nautical miles, in degrees of latitude and longitude. Later, if he makes the grade as a captain and completes a few trips overseas, he might come back to be initiated into the mysteries of celestial navigation and the use of the sextant.

Here he finds that, when we speak of radio navigation, we do not mean beam flying. If he has been an airline pilot in the U.S. he will miss that beam. On the way to Newfoundland there are numerous beams with which to check, but from there on it is done by radio direction-finding. Bearings are taken from the ship and by ground stations. The pilot must know how to take those bearings quickly and accurately, and how to make use of them after he has them.

There are many groans from the American pilot who, after flying for years on "compass headings," finds suddenly that there is no such thing. Instead, he must learn to navigate by the British system and the terminology is quite different. The reason is that he will be carrying a navigator who is a member of either the Royal Canadian Air Force, the Royal Air Force, the Royal Australian Air Force or Royal New Zealand Air Force—all of whom use the British system.

When finally he has proved himself proficient in this important part of his training the new pilot or "trainee," as he is called, enters into the second and last part of his ground training: the technical school. Under the tutelage of experienced engineers, the pilot goes to school for a week to study the airplanes he will be expected to fly. Here he must draw the complete fuel and oil systems of the Lockheed *Hudson*. He also must chart the hydraulic system and the workings of the automatic pilot, the flaps, landing gear, etc. He is taken out into the hangars where he has opportunity to put his hands on the gadgets he has been sketching. Every *Hudson* to be ferried across carries an extra gasoline tank in the cabin and another in the bomb bay, in addition to the four regular tanks in the wings. The two special tanks carry the necessary extra fuel for the long flight and are taken out when the ship reaches its destination. So, in the hangar he is shown how to use fuel from the tanks so as to keep the ship balanced He learns how to use the oxygen equipment, the Aldis signalling lamp, Very pistols, emergency escape hatches, and how to operate the automatic pilot. He is shown how to properly operate and make use of every bit of equipment in the aircraft.

At the end of the week a report is

made, showing instruction given and whether or not the pilot is ready for flight training. On a Monday he reports to the flying training department at the airport, where the chief flying instructor assigns him to an instructor. The first morning is spent in learning the peculiarities of the *Hudson*, where the many controls and instruments are and how to operate them. The morning's flying consists of practicing take-offs and landings. After lunch he goes up to 3,000 or 4,000 feet where he is shown the correct procedure in the event of an engine failure. This is important because if one engine fails with a full transatlantic load, only a correct procedure will bring the ship safely back to port.

After these preliminary checks he is sent up solo, with another trainee aboard to get the feel of the ship. Then comes the most important check of all. An instrument hood is put up and the pilot's ability to fly by instruments is checked. He must be able to steer a straight course within 5° and within an altitude variation of 100 feet. Precision turns, climbing and gliding turns—all must be accomplished satisfactorily, both with and without the use of the artificial horizon and directional gyro.

Some time also is spent in the Link Trainer. Then, at the end of the week, he is taken up for a final check. He plots a course to a point 100 miles away and return. He starts off assuming a dead calm, flying contact. After 15 or 20 minutes he must find a wind by visual fix, using his computer. After setting a new course for his turning point he is put under the hood. He now must fly by instruments to his turning point, then back to Montreal. At some point on the return trip the instructor cuts an engine. Upon his skill and accuracy in computing, and in his flying generally, depends whether he is made a captain, first officer or washed out.

The new captain is issued complete flying clothing, including fur-lined suit, boots, gloves and helmet. He gets a sextant, a complete set of celestial navigation tables, maps covering all of eastern Canada and Newfoundland, Ireland, Scotland and England; besides mercator plotting charts for the trip from Montreal to Newfoundland and across to the United Kingdom. He is given a chronometer, navigation and engine logs, flight plan forms, dividers, computer—even pencils and erasers.

His name now goes on the flight list to await his turn for a ship. He is assigned a radio operator and navigator. Most of the radio operators are Canadian civilians; there are a few English operators. Navigators are sergeants or pilot officers on their way overseas to an operational unit.

Let me take you with me on my first trip, which I made several months ago:

The night before my scheduled departure from our Canadian base, my radio operator and navigator met with me at my apartment. My operator was a keen lad of about 20. The navigator was an RAF sergeant of about the same age. I liked their looks. They were confident, but not cocky.

We spent several hours with maps spread all over the floor, planning each detail of the flight. Several of the older pilots who had already made a couple of trips had given me some valuable tips as to the location of certain dangerous balloon barrages, dangerous peaks and hills near our course, emergency fields for a forced landing on the other side, etc. These I marked on my maps with red ink.

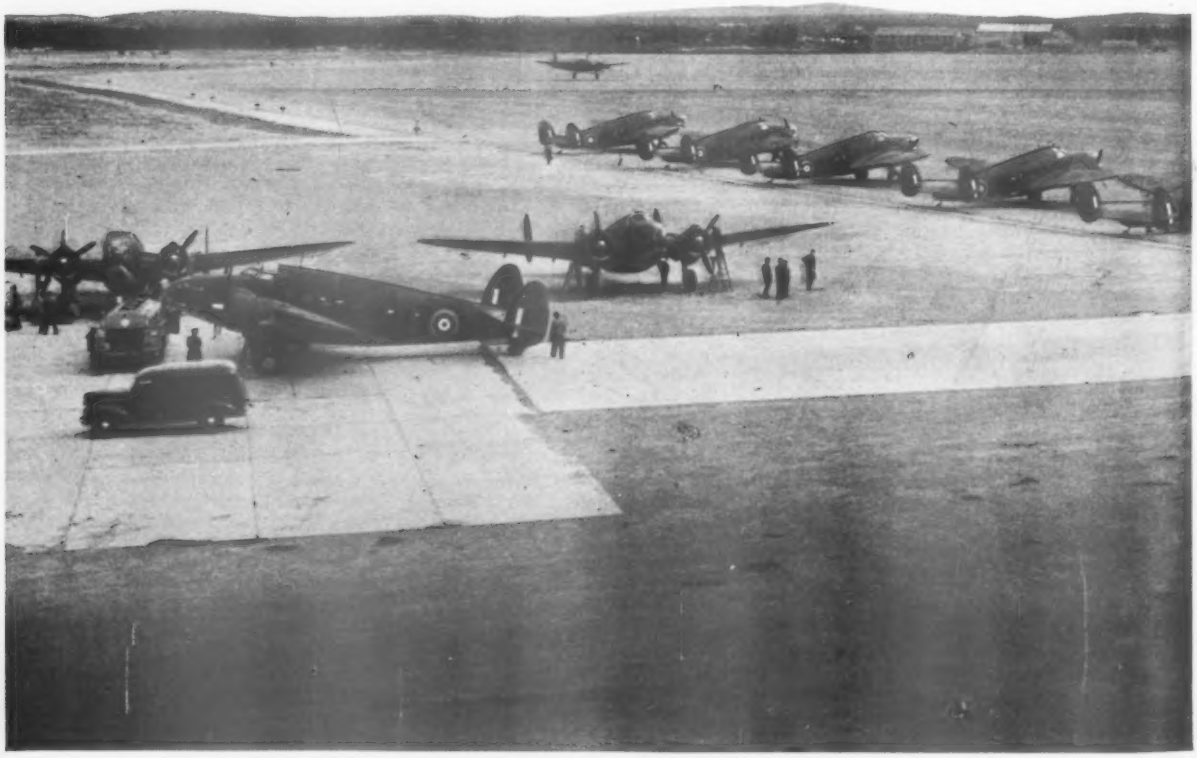
I carefully checked my navigator's knowledge of dead reckoning, radio bearings, conversion angles and so forth and found it excellent. I made certain that the operator had marked in his notebook all radio stations and beacons from which we could obtain bearings, and the times at which they broadcast. We agreed upon the procedure to be used. All messages and bearings received in flight were to be written in duplicate, one copy to be handed to me, the other to the navigator who would occupy the seat beside me. I was to carry no co-pilot.

Most captains have this conference with their crews before departure. It is good for morale and, as commander of an aircraft, I personally want to know something about my crew. I am sure they want to know what their skipper is like on a flight of this nature. After all, the lives of each depend upon the others.

We drank a toast—a "coke"; alcohol is forbidden 24 hours before a flight—and prepared for a night's rest.

The next morning we were at the airport, along with the crews of six other ships also going to Newfoundland. Each man is allowed 30 pounds of personal luggage; I'm sure I had 60. While the

These "Hudsons" wait for departure at Newfoundland base. As many as 16 have started en masse.



operator checked the radio I reported to the traffic office where I was given the ship's papers, a loading sheet showing the amount of gas I carried and an inventory list. With the navigator's help we quickly checked our equipment: Mae Wests, thermos bottles, flashlights, signal flares, compass deviation card, loop correction card, spare radio tubes—everything seemed in order.

After signing for everything I was given the test pilot's report on the ship:

"Gas consumption 59 gallons per hour. Not certain; check on way to Newfoundland.

"Loop swung at 10,000 feet. OK.

"Compass swung with generators on, antenna in, navigation lights off, cowling gills closed, at cruising speed. Compass correct only at cruising speed."

That seemed okay. Now to the radio room for a last-minute check on the chronometer. Ocean navigating is done in minutes and seconds and the time must be correct to the second, for celestial navigation. Finally up to the meteorology department where each captain was handed a report of the weather to Newfoundland. Here the navigator and I made out a flight plan together. We decided to fly at 9,000 feet. . . .

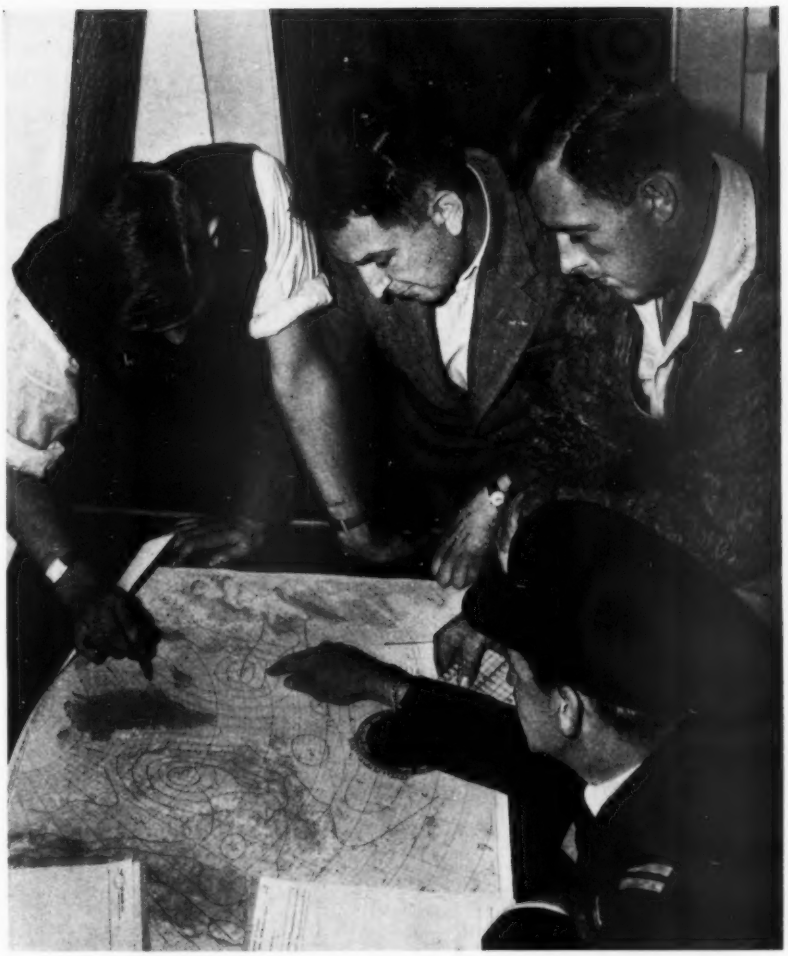
We took off on schedule. Twenty minutes later we levelled off at 9,000 feet and settled down to a 4½ hour flight to Newfoundland, almost 1,000 miles away. The flight was without incident; we were on instruments most of the way, flying by radio bearings. Newfoundland was a complete surprise. After flying for the last hour over barren rocks and woods dotted with swamps and lakes, we suddenly came upon the largest airport I have ever seen. The runways are wide enough for a whole flight of bombers to take off at once. It was one huge paved surface in the midst of a wild, almost inaccessible country of forest and lakes.

We taxied up to the end of a line of 16 other *Hudsons* which had been held up by weather. We were met by a Newfoundland ranger, who presented each of us with a yellow card which carried our name and which allowed us to enter the airport area. Here was evidence of the careful planning and organization behind this ferry service. A soldier guard was stationed along the line of ships (we now have a soldier assigned to each ship).

The crew chief asked if there was anything about the ship I wanted to report. His men were already removing the engine cowling for their routine check.

We were directed to the meteorology department where several captains, most of whom had been there a couple of days, were making out flight plans preparing to go across that day. I decided to stay overnight because the weather didn't look too good and, as this was my first trip, I was taking it easy. Sometimes we go right on after gassing up, if the weather permits.

I was taken over to the Eastbound Inn and shown to a neat little room. Amazed at the smooth-running order of things out in this wilderness, I decided to have a look around. There were two wooden "hotels" for the pilots and crews, a game room with ping pong tables, darts, card tables and a dining room where delicious meals are served. Over in the administration building were the business offices, weather offices, flying control tower, radio room and post office.



It is customary for pilots and crew members to meet the night before a flight to discuss plans. Here a group at Newfoundland base carefully studies weather charts.

Along one edge of a runway was a long line of bombers of the RCAF coastal patrol. Using my pass, I walked across to the other side of the field where I found a little "town" of barracks and officers' quarters. Walking along the muddy street, I passed enlisted men and officers in the uniforms of the RCAF, RAF, U.S. Army and even one or two U.S. Navy officers. The uniforms were wrinkled and mud-spattered. These men were up here doing a job, not on parade.

That night I slept well after a hot shower. Up at 8 a.m., I found the ship gassed, oiled, cleaned and a report of a complete mechanical check made. I found that there were to be 17 ships leaving that day. At a predetermined time, all captains and navigators reported to the meteorology office. Here we had a conference with the chief weather man, whom I believe to be one of the best in the world. We were shown a complete picture of the weather across the Atlantic, the position of fronts, icing levels, winds aloft and so on. Each captain was given a secret report consisting of the weather for each of the 10 zones across. From this we determined that 10,000 feet was the best altitude for favoring winds and lack of ice. We made up our flight plans together, checking each others' calculations.

I estimated my time across as 10 hrs. 21 mins. I will never forget that figure, because I landed on the other side exactly 10 hrs. 19 mins. after take-off. Partly luck, of course; but imagine being just two minutes early on a transoceanic flight!

The radio operator had loaded the food and coffee into the ship and obtained the necessary secret codes. Each ship has its own call letter. I reported to the duty control officer, where I left a copy of my flight plan. Here he showed me a secret map on which were marked all barrage balloons, defended areas and other vital points and gave me my secret orders, which contained the signals to be used in case of challenge by a boat or British aircraft on the other side.

I ran the engines up carefully, being sure to "bleed" the automatic pilot twice before carefully testing it. I couldn't for-

(*Continued on page* 96)

La Guardia's Beehive

by E. D. WARD

Airline terminals naturally are busy. But New York's huge airport is responsible for some amazing traffic statistics.

Not long after going into operation, La Guardia Field was hard-pressed to handle the traffic it attracted.

The field's control tower is completely equipped to handle any air traffic problem.

WHEN New York City's La Guardia Field went into operation in December, 1939, everybody was vaguely predicting a great future for the airlines. "Within five years," many said, "this huge airport will no longer be able to accommodate the traffic the airlines will be carrying." But nobody ventured a guess as to the amount of business that actually could be transacted at the new airport, nor the amount the airlines would be doing within a short span of months.

The airport opened during the start of an unprecedented period of activity for the nation's aviation companies. Business spiraled faster than even the politician's imaginations and reached a stationary level only when the Government began commandeering airplanes and forbade manufacturers from building commercial craft. Even yet—although the number of flights remains relatively stable—the passengers, mail and express show a steady increase. That magic index of airplane prosperity, load factor, continues its climb.

La Guardia Field itself, a $41,000,000 air terminus, not only has become the nub of the country's transportation system, but is big business in its own right, with an annual income from all sources

Several months ago La Guardia Field's control tower was handling an average of 250 flights and 3,500 passengers daily.

of nearly $700,000. During 1940 it accommodated 1,067,000 passengers and untotalled millions of sightseers. In 1941 it handled about 1,250,000 passengers. It is geared up for its third year of operation to handle more passengers and more visitors with greater efficiency.

Two hundred fifty flights a day were scheduled into and out of the mammoth port during October, 1941, exclusive of the three round trips per week operated by Pan American Airways. Some 3,500 passengers a day use the airport. Since December 2, 1939, when the port opened, the number of daily flights and passengers carried have nearly doubled; number of the airlines themselves have increased from four to seven. Yet the traffic is handled more expeditiously now than ever.

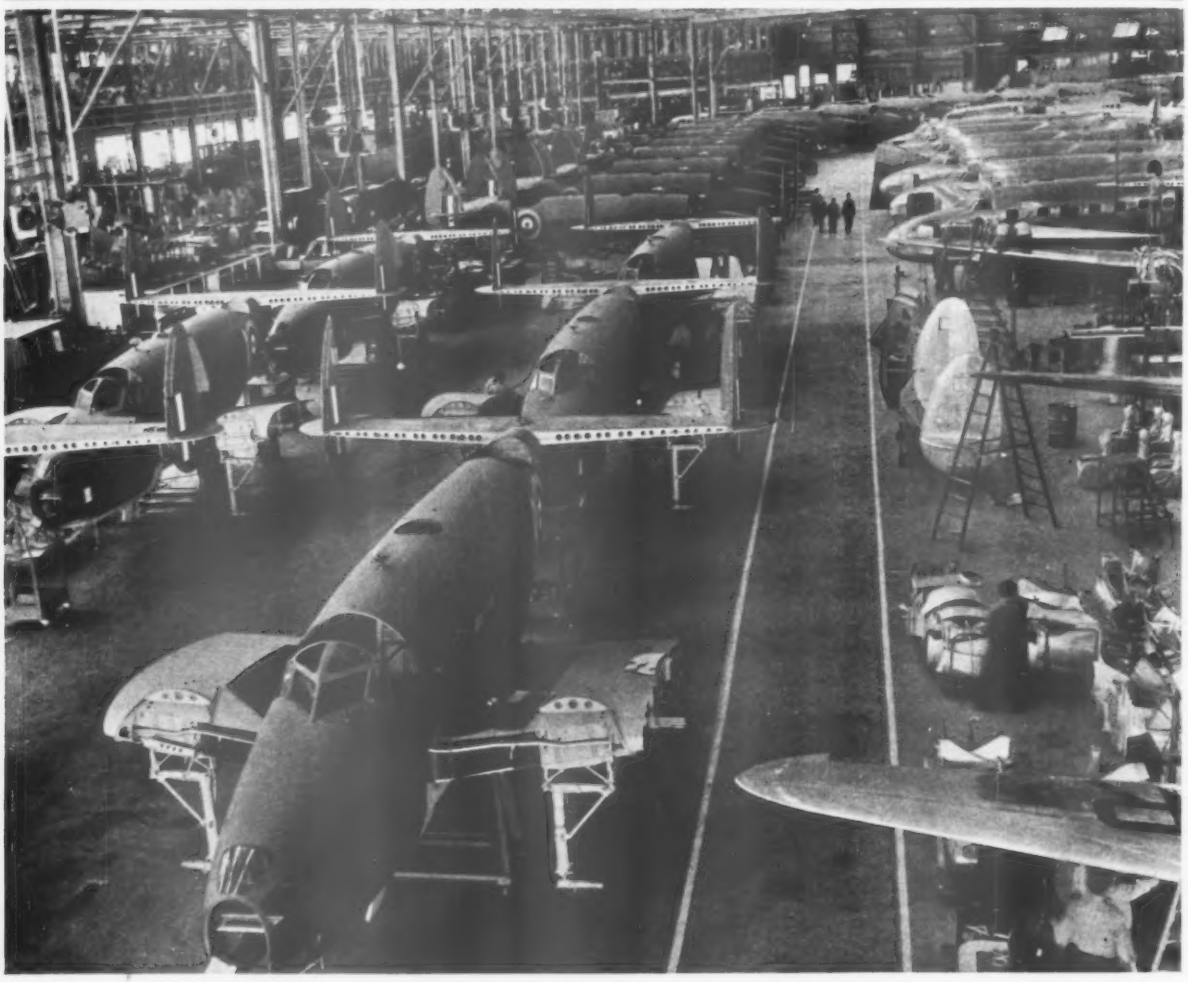
Never has there been an airport like La Guardia, whose feat in supporting itself is a novelty and a model for newer fields. When the airport opened, it appeared to most experienced airmen like an extremely commercial proposition. But that was only a sample of what has come to be.

Now the field derives revenue from so many sources that it is a continual wonder to men accustomed to airports that

(*Continued on page* 78)

Tower operators at the New York terminal are the busiest of any in the United States.

THE "HUDSON"



These "Hudson" production lines gradually will be turned over to the production of bigger "Ventura."

by KURT RAND

Fighter, patrol plane and dive bomber all in one, the Lockheed "Hudson" was converted from an airliner into one of the most legendary of the war's fighting planes.

AN airliner, with the passenger seats torn out but with the windows left in, went into the war in Europe as a stopgap in 1939 and has come out a legend. American aircraft manufacturers like to think of such unconventional situations as typical of the kind of airplanes being built by the people who invented the airplane in the first place. And well they might, for it isn't every run-of-the-mine airliner that can sail away over enemy territory and come home again hours later with an engine shot out by antiaircraft, shell holes clear through the wings and fuselage and half the crew dead. It isn't often that an airplane designed to carry you from Kokomo to Tallahassee can be flown into a full-fledged war as was the Lockheed *Hudson* to serve variously as dive bomber, fighter, reconnaissance machine and personal transport for His Majesty the King.

The name "Lockeed *Hudson*" has become a household word throughout the British Empire; with the Coastal Command of the RAF, in the countries that cluster about the Mediterranean; in Australia, Malaya and Singapore. Wherever the British Lion takes its stand there are *Hudsons* somewhere about—hundreds of them, and still more hundreds are on the way. These first American-made warplanes to see action in substantial numbers have built for themselves a reputation for ruggedness, durability and the ability to "take it."

The praise comes from the mechanic who works in shops at airdromes where the planes come for repairs and from the King who lives in a palace. Workers say that the Lockheeds are structurally built as warplanes should be; that it is comparatively easy to replace vital parts that are bullet-riddled without too much loss of time. And the King's praise is evidenced by the fact that a *Hudson* has been specially fitted as his private plane.

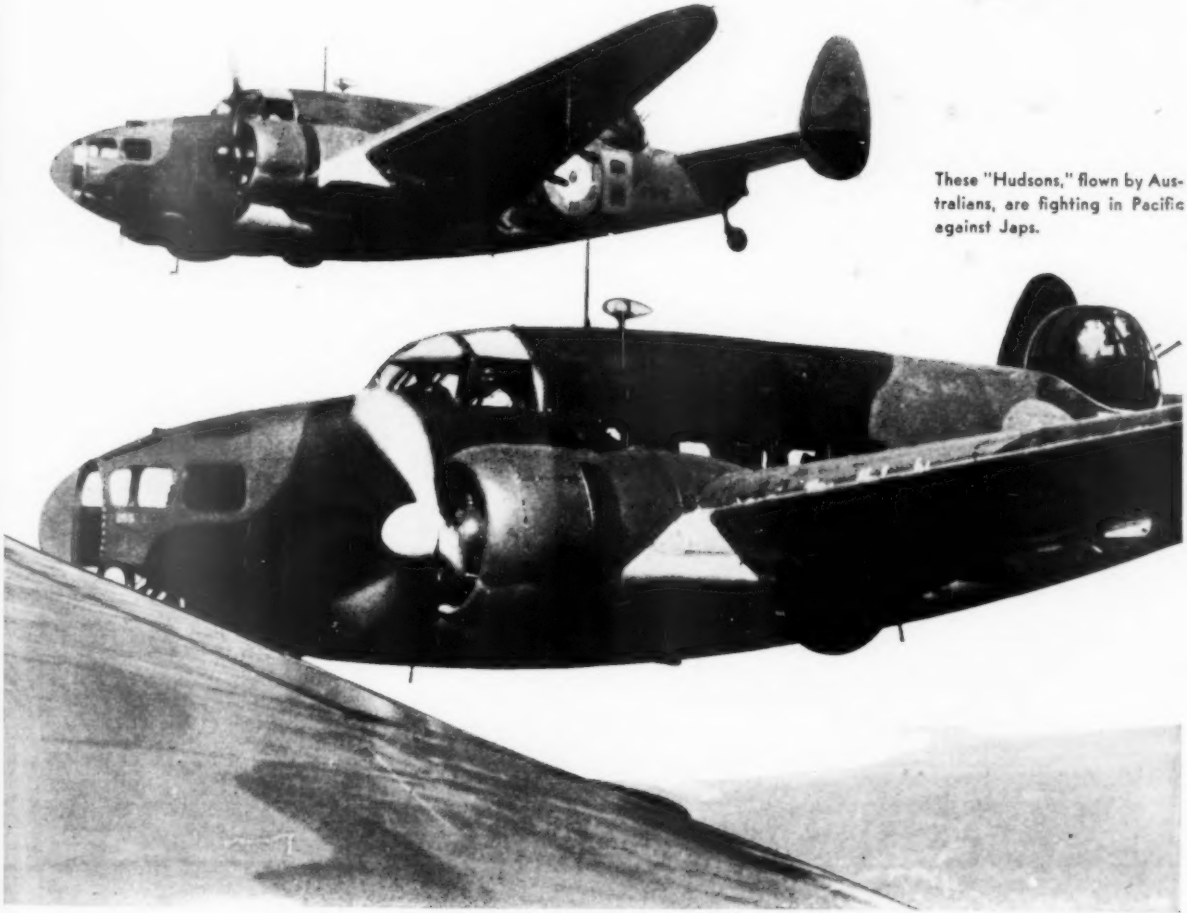
The interior has been rearranged to carry six passengers and the craft has increased armor plating. He flies in it with Wing Commander E. H. Fielden as his pilot. Occasionally the King takes over in the air.

Mechanics, when the first Lockheeds arrived, had but one complaint. They couldn't understand the "shop talk" of the American engineers. Such words as gasoline for "petrol," engines for "motors," weren't confusing; but structure for "chassis"; plumbing for "petrol feed pipes"; wobble for "fuel pump"; horizontal stabilizer for "tail," stumped them. The American experts quickly taught them the slang phrases. Now the British use them.

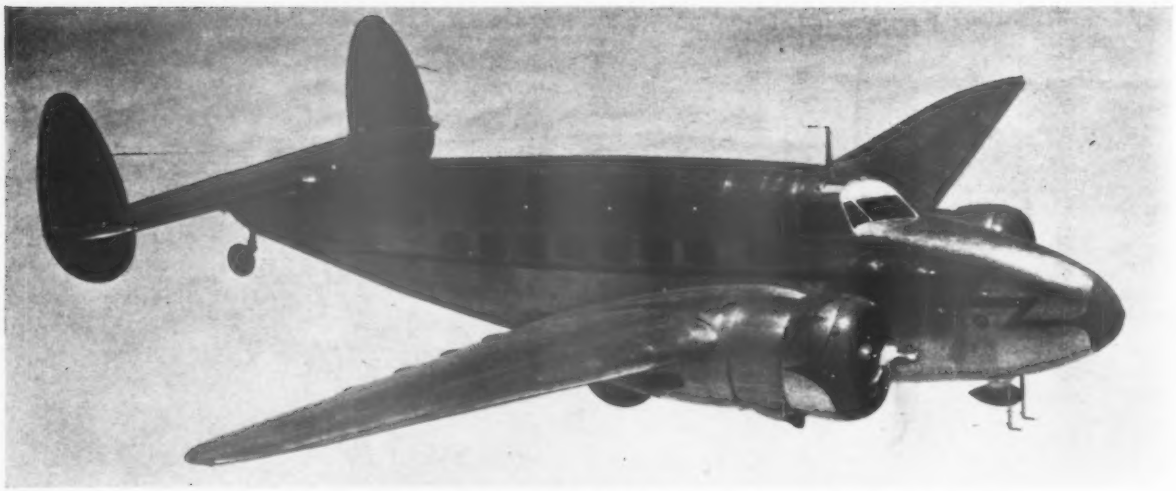
Britain has received more than 1,500 *Hudsons,* some by boat, others by air. More of them have flown the Atlantic than all other types of planes put together. Only one has been reported lost by the Ferry Command in delivery flight across the ocean. But the *Hudson* is the military version of the Lockheed "14," a veteran of Atlantic crossings. It was in this type ship that Howard Hughes spanned the Atlantic in 1938.

The story of the *Hudson* began at home. It started as a business tip, became a mock-up, progressed into a stage of draftsmanship and design, became a small model, and finally emerged a masterful hunk of salable material which Lock-

Lockheed recently was producing "Hudsons" so fast that finishing touches were put on them outside the factory building. These are being readied for transatlantic hop.



These "Hudsons," flown by Australians, are fighting in Pacific against Japs.



The "Hudson" differs little in outward appearance from this early "14," even retains cabin windows.

No. 250, last of initial "Hudson" order, was completed seven weeks ahead of schedule.

Majority of "Hudsons" originally went to RAF by boat, now are mostly flown across.

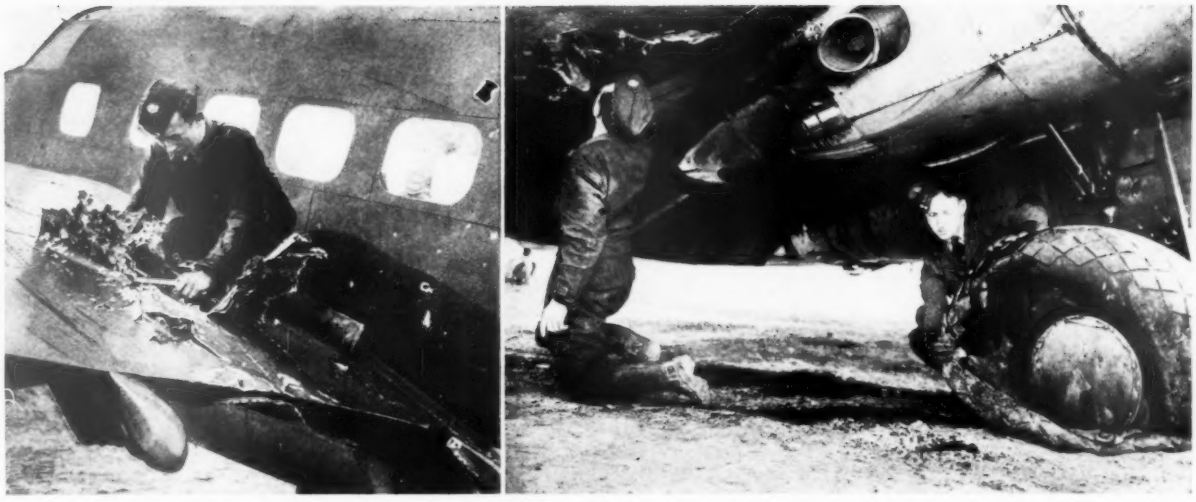
heed turned into a $25,000,000 contract—the biggest ever landed by a domestic aviation company prior to the war's outbreak.

The tip came from "a friend" in the east who called a Lockheed sales manager long distance and informed him that five Englishmen—members of a British Purchasing Commission—were in this country touring eastern aircraft plants looking for a good medium reconnaissance bomber with a fairly long range and fine stability, which could serve as a patrol bomber with the RAF Coastal Command.

In Lockheed's grab bag of military airplanes there was one ship—the XP-38 still in the experimental stage and a confidential project for the Army Air Corps. The company had never built a military airplane save a few regular transport models for the Army which were military only in the sense that they belonged to the Air Corps, bore U.S. Army markings. Furthermore, the company had no particular desire to build one. There were no military designs on paper for a bomber of any sort in the engineering laboratories. But the $25,000,000 prospective order looked good to Lockheed's financial advisors and they decided to get a chunk of it.

Engineering initiative, a requisite of the company since the creation of its fastest commercial transport (Model 14) a few years back, went to work with all its ingenuity. Within 10 days, two alternate wood mock-ups—military versions of the famous "14"—were ready for the British commission to see. The prospective buyers came and looked and were impressed.

A few days later, Sir Henry Self of the commission invited officials of Lockheed to London—the trip to be paid for by Lockheed if a deal was closed, but a free boat ride at the expense of the British if no contract materialized. Five men—Courtlandt S. Gross, then head of the New York office and now Vega's President; Carl B. Squier, Vice President and General Sales Manager; R. A. Von Hake, Vice President in Charge of Manufac-



Direct hits on this RAF "Hudson" included shells through center section and landing gear. Wounded crew flew it home.

turing; C. L. (Kelly) Johnson, Chief Research Engineer, and Bob Proctor, attorney—made the trip.

Secretly, upon arrival, they rented living quarters on an unobtrusive street off Piccadilly Circus. Several times they changed dwellings, using assumed names in order that their presence would not become known to the press or British manufacturers. But all the while, they were working—transacting business with almost every department in the British government. All they had with them was a set of blueprints, confidence in the ability of their rather limited manufacturing facilities to do the job and a reputation for turning out fast, reliable, record-breaking airplanes. When they left they had a juicy contract.

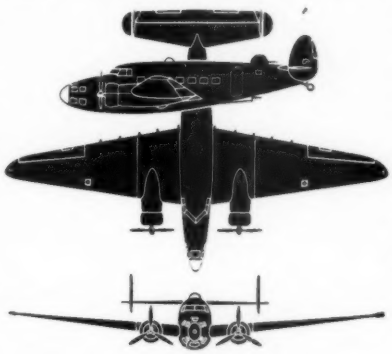
By its terms, the company was to build 250 military versions of the "14." All of the planes were to be delivered by the end of 1939. The order was a big one for a company with only 240,000 square feet of space and less than 2,000 employees.

Here was a typical production problem: The skin on the *Hudson* was a little thicker than the covering on the commercial transport. Riveters, who were expert at putting together the "14" found they couldn't do the job with equal ease on the bombers. There was an entirely different "feel" to the riveting. For a while the riveting on the first bombers had to be done over until skilled labor could be schooled to the problem.

Turning the commercial transport into a military version was not too tough a job although it did present many difficult problems. The windows were left along the sides of the cabin because it was easier to leave them there than to change the design and take them out, and because it is the job of a reconnaissance plane to see things. Cabin heating and many other comforts of commercial aircraft were left in the plane as a boon to the men of the RAF who must spend long, relentless hours in them, and the Sperry automatic pilot was included as standard equipment just as it had been in the airliner.

Commenting on these features an RAF pilot remarked: "From the standpoint of comfort, there is nothing that can beat the *Hudson*. And comfort means a lot to us when we have to spend long hours cruising over the North Sea towards the coast of Scandinavia. The layout of the instrument board is superb. It shows the influence of motor car manufacturing principles on aircraft design. They don't sell warplanes on a popular appeal basis, so it is very pleasing when we see commercial ideas coming to the aid and comfort of military airmen."

The first bomber came off the line, completed all its tests and was flown to New York for delivery to London late in January, 1939. By the end of June only 50 of the planes had been completed. This meant 200 more had to be built in the next six months—six planes more than the company had produced in the first six years of its existence. At the same time, the task had to be accomplished without interfering with the company's production schedule on a full line of commercial airliners whose purchasers were in all parts of the world. The aviation industry was betting against it, as the task seemed an impossible one. Then Lockheed turned on the heat. Personnel was increased from 3,000 to 7,000; production lines buzzed with activity: big hydraulic presses stamped out bomber parts like automobile fenders; a well-stocked supply room kept materials coming in without any halts. Seven and one-half weeks ahead of schedule the last of the 250-plane order was finished. However, the company did not stop building the bombers. Again and again the British have renewed their order for these planes that they named after the famed British navigator and explorer, Henry Hudson, who piloted the fast, sleek sailing ship *Half Moon* across the Atlantic and discovered Hudson Bay in Canada. And it is from secret landing fields along the shores of this very Bay that the fast, sleek bombers hop-off, Britain bound.



Easily recognizable "Hudson" characteristics are twin rudders, cabin windows and stubby projections of Fowler flaps.

The military version of the "14" was to meet these performance figures: Normal power rating to 6,700 feet, 900 h.p. per engine, of which there are two, Wright *Cyclones* or Pratt & Whitney *Wasps*. Take-off power, 1,100 h.p. at 2,350 r.p.m. Critical altitude, 8,000 feet. Maximum speed, 246 m.p.h. Cruising speed, 220 m.p.h. at 12,000 feet. Landing speed, 70 m.p.h. Initial rate of climb, 2,180 feet per minute. Climb to 10,000 feet, eight minutes. Single engine ceiling, 11,000 feet. Absolute ceiling, both engines, 26,000 feet. Take-off run at sea level, 920 feet. Operating range, 1,960 miles.

These performance figures have since been improved upon in later models in order to keep pace with the developments of the war. The British are silent about the present speed, altitude, range, but they say the latest planes carry more armament. There are window guns, installed in England; two fixed machine guns in the nose; two turret guns and a tunnel gun. More powerful engines have been installed. Flush riveting has added many miles per hour to the speed, upped the ceiling and increased the range. The *Hudson's* performance has proved that it is possible to convert a civil airplane into a military aircraft and combine the better features of both.

When a finished *Hudson* rolls down the line at Burbank, it is test flown by Lock-

(*Continued on page* 86)

WSN: An Industry Based On the Stars

By William Winter

Phillip Van Horn Weems started his business in a single room. Now he runs a navigational supply house and schools all over the country.

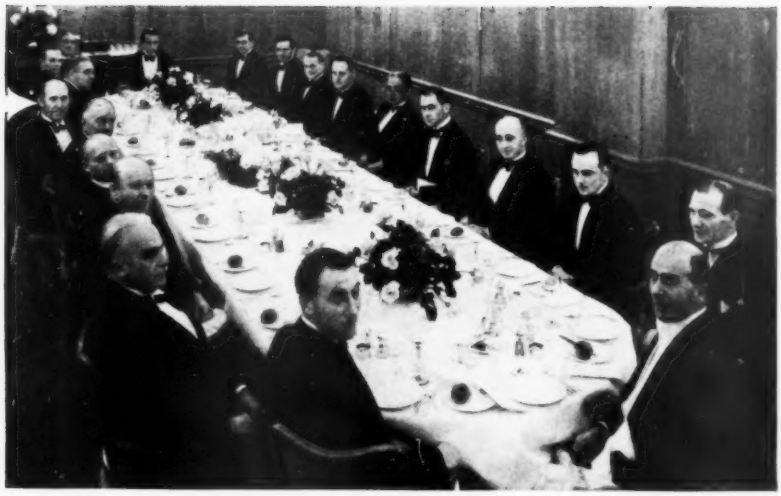
Handbooks and charts are compiled and published by the Weems organization. Navigational instruments are designed, manufactured and sold by the Weems group.

HAROLD GATTY, the navigating end of the Post-Gatty team, was the guest of honor at a banquet in Washington. It was just after Post's first flight around the world. The assemblage was studded with admirals, many of whom had heard of Gatty's classic feat of celestial navigation that brought Post down through the overcast at night after long hours of flying, smack over a Russian air field. But neither the admirals nor Lieut.-Comm. Phillip Van Horn Weems, seated at the "white meat" table, expected Gatty to hand Weems so much of the credit. It seems that Weems had developed several navigating devices used by Gatty on the flight. Weems was surprised, the admirals jolted into the realization of the value of such navigation to the Naval air force. The next day Weems received a phone call from an admiral that led to Weems becoming research officer for aerial navigation for the Navy.

The amusing twist to the incident was the fact that Weems, then in active service, already had submitted numerous reports and had patented several navigation gadgets through the Navy. So all he did for a starter was to go to the Navy files where the material reposed. Right off the bat Weems revolutionized aerial navigation by converting the Bowditch tables into an aircraft plotting board and flight calculator that rested on the navigator's or pilot's knees. The plotting board gives a graphic solution of navigation problems by a convenient means for plotting on a chart that shows directions and distances. With it may be combined a slide-rule computer for doing speed-time-distance problems. Previously, it was necessary to look up values in the Bowditch tables and then do the problems by long-arm arithmetic. About that time Weems designed the Air Almanac.

As director of aircraft navigation research, Weems encouraged anyone with an idea. "Give it a chance" was his motto. That is how he met the late Phillip Dalton, wizard design engineer and Navy pilot whose inventive genius cre-

P. V. H. Weems today, at 42, operates the famed organization which bears his name.



Recognized internationally as one of the few authorities on the science of aerial navigation, Weems (arrow) was feted by British scientists in London a few years ago.

ated so many of the plotting boards and flight calculators popular with airmen the world over. Recognition of ability, a lightning grasp of the possibilities of even a chance suggestion and a flair for organizing the creativeness of other people—to say nothing of his own—on a mutually satisfactory basis, is the story of the amazing success of the Weems System of Navigation.

The Weems System is big business. The gross for the first seven months of last year was well over $100,000. The name Weems System is a misnomer. Actually, the name Weems System was given to the Line of Position book written in 1927. Like Topsy the business grew since then to include, besides schools in 14 cities, three other classifications of products: navigation books and equipment (six books and four charts); dead reckoning equipment, which includes three of the famous Dalton plotting boards and four of his flight computers, the Gatty drift indicator, the popular Mark 2 aircraft plotter and various other calculators, note books, plotting sheets; and celestial navigation equipment, including sextants, special watches, star charts and the Star Altitude Curves, American Air Almanac and the ever-successful Line of Position book.

Four books—Air Navigation, Marine Navigation, Instrument Flying and Radius of Action of Aircraft—each sell approximately 2,500 to 3,000 copies a year. The simple Mark 2 aircraft plotter is selling at the rate of 50,000 yearly. The Army Air Corps has ordered 42,000, the CAA 4,100. The Dalton computers sell by the thousands. Sales of 15,000 copies of the Star Altitude Curves grossed $75,000; 8,900 of these books were delivered recently to the Air Forces.

When Weems retired from active service in 1933 he started his present business in a single room. The first year he cleared only $480, the second $960 but, by 1938, the upswing in flying boosted the yearly gross to $25,000. And as already noted current sales are skyrocketing. For the use of various gadgets and books pioneered by other navigators Weems pays up to 20 per cent royalties. For the Brownell-Weems Star Finder he pays $1 for every one sold. "The name Weems means nothing," he claims. "It's worth paying for a name like Dalton or Gatty. That sells them."

The "one-two-three" system of instrument flying is known to every pilot. This is nothing more than a sequence of reading the turn-and-bank, airspeed and rate of climb indicators, that rules out confusion while flying blind. The late Howard Stark invented the one-two-three system and used it in his book Instrument Flying. After Stark's death, Weems arranged to buy from his widow all rights to publish the book. He had two reasons for buying these rights. One was to get the name Howard Stark, the other to control Stark's one-two-three system. Weems has the jump in his field primarily because he never lets grass grow under his feet.

Weems recalls a humorous story from his battlewagon days, which illustrates his readiness to take suggestions. One day on the *Wyoming* he was doing navigation problems with one of his plotters (the grandpap of the present Mark 2 plotter). This plotter resembled a celluloid ruler with a protractor attached flat along one edge. At the center of the radii of the protractor was a hole through which a pencil point was inserted as a pivot for turning the plotter while working problems. At the intersection of the outside edge of the rule and the protractor, Weems cut a makeshift notch for marking other points. Young Midshipman Wyman Howard came up behind Weems and peered over his shoulder. Finally he drawled, emphasizing each word in turn:

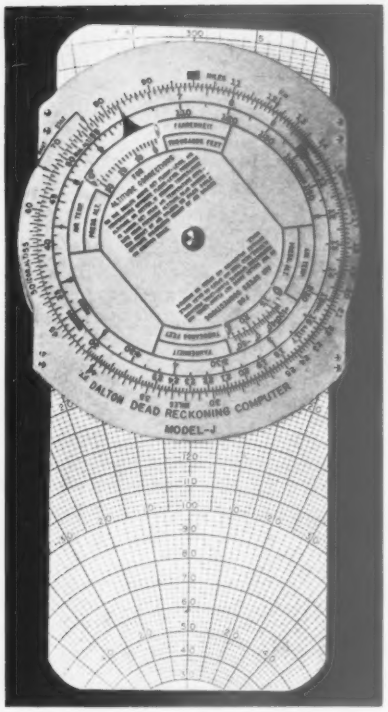
"Commander, why don't you put a hole right there?" And he put his finger on a mark.

Weems chuckles at the memory. "Why, that hole is worth $10,000 to me today."

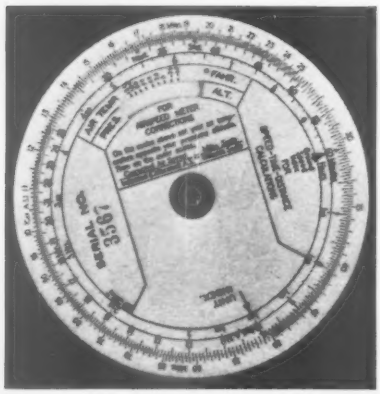
The Weems System of Navigation has no competitors. For this reason. Expressed in a nutshell, the Weems policy has four facets. First they design the item; second, they make it; third, they teach it; and fourth, they sell it. The Government may teach identical subjects, Pioneer or some other manufacturer may bring out similar gadgets, McGraw-Hill or some other publisher may create competitive books. But no one is able to exploit a navigation idea through these four phases together. The Government does not manufacture, Pioneer does not teach, McGraw-Hill does not manufacture or teach. Weems has his system. He gets his cut one way or another.

Too often in the industrial world competition is met by lowering prices—and often by lowering quality to make those prices possible. Weems gets a good price for his products. Accuracy and quality, in the judgment of his legion of customers, make them worth it. A single book illustration may cost Weems $50. The books themselves are bound in semi-limp leather; the paper is the very best rag stock. The type is large and bold, the illustrations as big as the page sizes permit. How quality and reputation pay dividends is indicated by the simultaneous publication of a new star finder by both Weems and the Government. The Government star finder sold at $1, the Weems item at $5. Although Weems had his fingers crossed at first, his calculator came through with flying colors.

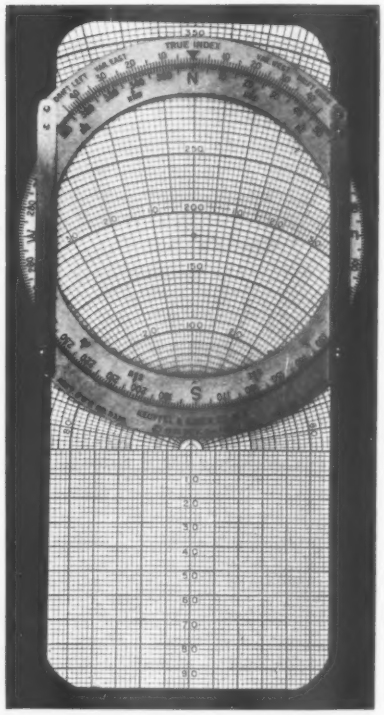
The Weems System traces back to a day in 1926 when Lieut. J. E. Gingrich and Weems, then instructor at the Naval Academy in Annapolis, were discussing navigation tables. Gingrich saw what he thought was an improved method. Weems, always hair-trigger quick about constructive suggestions, agreed to work with Gingrich on what later became known as the Line of Position book. When the idea was suggested to superior officers it caused so much friction that Gingrich feared for his career and dropped out. Weems carried on. He agreed to pay Gingrich $100 if the book was successful. Rear Admiral Moffett himself finally authorized the purchase of 100 copies, the Hydrographer another



One standard type of dead reckoning flight computer is this Mark VII, another Dalton.



Standard equipment on American Airlines, this compact computer is a Dalton design.



This Dalton aerial drift calculator was created in 1935, is still used by Weems.

400. The Line of Position book sold 3,000 copies the first year. Since then it has seen three editions and six printings.

After his retirement, Weems was invited frequently to lecture on navigation at such places as the Franklin Institute in Philadelphia and the Hayden Planetarium in New York. Soon he found himself lecturing on a regular circuit. The obvious solution was the conversion of these lecturing points into navigation schools.

Here again Weems had the magic touch. Three hundred to 400 students a year graduate from the Weems schools in 14 cities: Annapolis, Baltimore, Boston, Denver, New Orleans, New York, Philadelphia, Los Angeles, San Diego, San Francisco, Miami, Seattle, Springfield and Washington, D. C. The New York school alone has eight teachers. The school business developed like Alladin's genii, forcing Weems to farm it out to independent people and agencies. "Big shots" received their instruction at Annapolis where Weems himself is located. Alex Papana, Amy Johnson, Julius Fleischman (now Naval attache at Ottawa), Jack Lambie of Eastern Air Lines and Baroness Lizette Von Kapri, are just a few of the notables schooled at Annapolis. In addition to the regular school courses there are correspondence courses for both air and marine navigation. The Maritime Commission has contracted for correspondence courses for their cadets.

Head of the San Francisco branch of the Weems System schools is Mary Tornich, another Weems find. She is a foremost authority on aerial navigation. Her book Radius of Action of Aircraft is one of the Weems best sellers. Currently, she is teaching Air Force flying cadets the vagaries of navigation. She was navigation instructor for the CPTP at the University of California. Commander Weems discovered Mary Tornich while she was studying navigation at the University of California Extension, where she was the only woman in a class of 60.

One stormy day some years ago a battered sailboat put in at Annapolis for shelter. Col. Alexis Illyne was stranded. Being interested in navigation it was inevitable that Illyne would run into Weems. The two hooked up at a time when the Weems business was taking its first faltering baby steps. Things were too shaky for Weems to pay the colonel a decent salary. He did promise him whatever he could spare. In the beginning Illyne made only $5 a week. Today Colonel Illyne, the former White Russian refugee, is famous for his star charts. He is a pillar of the Weems System. To put it facetiously, "he is doing all right." Weems himself holds four patents, two joint patents—one with Gatty—and 15 copyrights. "That's counting right off," as Weems says.

While the commander was stationed in California, his Star Altitude Curves attracted wide newspaper publicity. Lincoln Ellsworth read the account and, after checking the star curves for his own satisfaction, became so enthused that he contributed $700 to help organize the buisness.

A crude explanation of Star Altitude Curves can be given by considering a star as the apex of a Maypole. If the observer stood 100 feet away from the pole and sighted on the top of it, the imaginary line running from his eye to the pole would form an angle with the ground. This angle would grow less as the observer backed off from the pole. If the observer walked around the pole each time he paused to sight the top of it a number of concentric circles would result. The Star Altitude Curves are based on this idea. However, the concentric circles are drawn around two or three stars so that one set of circles forms intersections with the other sets. These intersections are used for plotting position on long flights. This method cannot be used with the moon and the sun since they follow an erratic path through the sky. The apparent movement of stars, except for the earth's rotation, is infinitesimal. Star Altitude Curves may be prepared four years in advance and can be used for eight years without any serious loss in accuracy.

The Weems Star Curves are playing their part in the bombing of Berlin, Hamburg, Cologne and other RAF objectives. The British have a unique navigation machine called the Astrograph. The Astrograph is a sort of projector. All it does is project the Star Curves from a small housing above the navigator's table onto a chart or map. The housing contains a bulb and a roll of film bearing the impression of the curves. When the navigator "shoots" the specified stars he is able to note his plane's position on the map relative to the projected Star Curves. This is a matter of seconds. The principle of operation is that any given section of film at any given time will cover the same band of latitude on the navigator's chart, simply by placing the reference lines on the image over parallels of latitude on the chart.

The Germans do not have a similar device, it is thought. No doubt British bombers have been brought down over Germany and the occupied countries and, doubtlessly, the Astrograph has been thoroughly scrutinized. It took the British a year to develop the machine and the Germans are expected to take that long to duplicate it. Coincidentally Weems is developing an aircraft plotting board for dead reckoning that permits the navigator to place his chart beneath the plotting discs. Position is found directly on the map.

Randall House, Annapolis—nerve cen-

(*Continued on page* 112)

TROOP GLIDERS

This two-place Schweizer glider is being used to train Army officers as pilots for troop-carriers.

by LEWIN B. BARRINGER

American ingenuity is developing troop-carrying gliders that will outstrip efforts of the enemy.

AT the banquet closing the 12th annual National Soaring Contest at Elmira, N. Y., last July, Lieut. Gen. Henry H. Arnold, Chief of the Army Air Forces, made a stirring speech. This address was given the widest publicity because it marked a new milestone in American military aviation—the official recognition of the glider as a potent military weapon.

Fresh in the minds of the public was the successful invasion of Crete by air and the important part played in that history making battle by the troop-carrying gliders. Heartening then it was to hear from the chief of our fast growing Air Forces that gliding and gliders had not been overlooked and that now we were to have a glider force second to none.

In the months that have passed since then we have read and heard numerous exaggerated and even fantastic stories about military gliders by so-called experts. Totally lacking, however, has been any news of the Army doing anything about them. This has led to rumors that nothing has been done or would be done, that the first announcement was nothing but a bluff to quiet the growing clamor of public opinion. Whoever started such rumors certainly has no conception either of the character of the Army's top airman nor the energy and ingenuity of the materiel and training divisions of the great air arm he is building up.

Let me say here and now that not only has the Army not permitted any lag in the glider program, but it has in fact brought it well along the development path which will make it an important part of our aerial strength. During the past several months engineers have been working steadily designing and building large gliders capable of carrying from five to 15 ground troops with full military equipment. The reason that nothing has been heard of this is that the work has had to be carried on in secret—as many details of it must now remain.

Any day now some of these huge, silent craft—large as airliners—will be seen in the air over Wright Field, the Air Corps' great experimental base near Dayton, O. Not only would it then be impossible to keep the existence of these gliders a secret with thousands of people seeing them towed aloft on test flights, but also, if this were possible, it would be an injustice to the public which should be told what is being done.

Let us examine for a moment just what the tactical usefulness of the large glider is. As developed so far there are two basic uses. First is the air transport of men and supplies from one location to

One of the best known, veteran pilots in this country, Lew Barringer is now head of the Army's new glider training program. Stationed in Washington, D. C., he is an expert on gliding, has written several articles for this magazine on the subject, besides being author of the book, "Silent Wings," a detailed account of the art of soaring. In addition, Barringer is a veteran of more than 2,000 hours of powerplane flying.—Ed.

One of the German troop-carrying gliders that crashed during invasion of Crete. The ships carried 12 to 15 soldiers and were towed in train behind Junkers transports.

another. Second is the surprise attack on enemy positions by air-borne shock troops.

In looking into the practical reasons for the use of gliders for transport we come to the fundamental truth that you can tow much more than you can lift. This is the basic reason for the economic justification for a locomotive towing a train of cars, a truck towing trailers or a tug towing barges. From what we now know we can say that when large numbers of men and considerable amounts of supplies are to be moved by air an efficient way to do the job is by gliders towed behind airplanes.

In continuing the comparisons we find that the rails supporting railroad cars, the roads supporting the truck trailers and the water supporting the barges compare to the air supporting the gliders. Similarly the friction of steel wheels against rails, rubber tires on roads and boat hulls through water compares to the aerodynamic drag of the glider towed through the air.

The thought naturally comes to mind: how about freight and passengers carried by glider trains? My answer is that this is bound to come in the near future. As commercial aviation grew out of the technical advances of the first World War so this very important phase of aerial commerce will grow out of the use of troop gliders in the present war.

We can visualize long-range towing airplanes (the British call them "tugs") designed and built for this specific purpose and carrying crew, radio and fuel with all passengers and freight being carried in the towed gliders.

A basic development that will make the launching of trains of troop gliders as well as future freight and passenger gliders practical was recently tried out at Wright Field. Resting motionless on the ground a glider was picked up into towed flight by an airplane passing overhead at close to 100 miles an hour. Following this successful experiment, the first ever made in America, we heard that such pick-ups had been made in Russia. Details of the Russian method are not known. Our pick-up system, a product of typical American ingenuity, is still in the early experimental stage.

The mere fact that the idea works has convinced me that we are well on the way to the solution of two important problems in the use of gliders for transport. The first is the launching of trains of large gliders out of average airports. The second, more a commercial than a military problem, is the picking up of gliders by a "through plane" without landing.

Let us consider the first problem for a moment. Suppose a transport plane such as a Douglas DC-3 is to tow three large gliders capable of carrying 15 passengers each. The gliders will be in an inverted V-formation, each with its own towline to the towing ship. Let us assume that the necessary spacing will make the total length of the train about 500 feet. This means that there will be that much less airport for take-off. Suppose the drag of the gliders lengthens the airplane's take-off run by 800 feet. This then will mean the same as a total of 1,300 feet of runway eliminated. When added to this we have the consideration of the rate of climb being greatly reduced the problem assumes large proportions and limits the use of such an arrangement to the largest airports. Obviously this would not be practical either for commerce or for military considerations. On the other hand, with the pick-up scheme it will conceivably be possible to tow a train of gliders out of a field too small for the safe take-off of the airplane alone.

Let us take a look into the future and imagine commercial operation of glider freight or passenger trains. We can think of a non-stop train operating between New York and San Francisco. In tow at 200 m.p.h. we can visualize six freight-carrying gliders. One of these is consigned to Akron, O., where another is to be picked up. A mile from the airport, during the let-down, the pilot of the first glider releases his towline and glides in to land. At about 120 m.p.h. the train continues, swoops low over the pick-up station, hooks on the towline and the other glider becomes part of the train. This process is repeated in variations of several gliders released or picked up at a time as the train continues.

In considering the economic reasons for the use of large gliders, both military and commercial, the operating saving in having two engines do a job now requiring eight, is immediately obvious. Far greater, however, is the saving in equipment cost. It has been estimated that the job of moving one air-borne battalion of infantry, consisting of about 800 officers and men with full equipment, would require 50 transport planes. Under proper conditions this same job might be done by 18 transport planes towing 48 gliders, with a considerable saving in cost.

Now let us consider the second military use of the troop gliders—for attack. So far we have been able to get only scant information on this use by the Germans. However, it seems that this probably was Hitler's vaunted "secret weapon" in the invasion of the lowlands. It now seems pretty well authenticated that key Belgian forts as well as important bridges over the Albert Canal were captured by shock troops landed in gliders. These surprise attacks were probably made by towing the gliders at night to a point 10 to 20 miles from the objective at sufficient height and with perfect timing so that the glid'rs could land, unseen and unheard, in the first faint light of dawn.

The successful air invasion of Crete was probably the first time that troop gliders were used in any numbers for attack. Even here many details must still be learned before we will have the complete picture. However, we do know that the gliders were of 10 to 12 men capacity. They were said to have a span of 80 feet, length of 50 feet and an overall weight of around 4,200 pounds. Construction of these gliders was of wood for the wing and welded steel tubing for the fuselage, the whole being fabric covered. A two-wheeled landing gear was used for take-off and dropped in flight, leaving only the wooden skid for landing, which was probably done at 35-40 m.p.h. They were towed behind the Junkers Ju-52 trimotored transports, similar in performance to our old Fords.

While not replacing paratroops, troop gliders would seem to have certain definite advantages over them in some respects and in certain situations. Chief advantage is the ability to land a compact combat unit, together and with weapons ready to use.

Among the exaggerated news stories we have read of the invasion of Crete have been those that claimed that the gliders did the larger part, if not the whole job that turned the tide in favor of the Germans. This is, of course, not true. Gliders were used in numbers, but constituted only one of the methods of transporting troops from Greece over the

(*Continued on page* 118)

These are typical of some of the aviation music left to posterity. "Come Josephine . . ." probably is the most popular air song written.

OF PLANES THEY SANG!

by E. JAY DOHERTY

This, we believe, undeniably proves that aviation has been everywhere. Limber up the quartet; here's the music.

Bella C. Landauer

"SINCE Katy the Waitress Became an Aviatress" may sound like double-talk to you, but it's a bona-fide item of historical information. This is just one of 1,500 song titles included in the collection of aviation music at the Institute of the Aeronautical Sciences. Here, accurately indexed and beautifully mounted, is the only known collection of its kind stored away where those interested in aviation history and curiosa aeronautica can browse through two centuries of musical preoccupation with flight.

Aeronautics is one of the very few sciences whose every step through the years has been accompanied by world-wide interest and depicted accurately in block prints, etchings, lithographs, paintings and photographs. The popular imagination has always been so stimulated by the conception of flight that we now have available illustrations in the form of historical drawings, artistic paintings, caricatures and illustrations for publications, bookplates, advertising and music.

Perhaps the most colorful illustrations are those which adorn sheet music. In the Landauer collection you can find songs, the illustrations for which range from the bizarre to the commonplace, from the screamingly funny to the unimpressive, but colorful and interesting.

The earliest known aeronautical song was published in 1785. Titled "Chanson sur le Globe Aerostatique," it pictures a Montgolfier balloon ascending from the Tuilleries in Paris. It has been followed by countless musical compositions dealing with phases of aviation. Every event in aviation seems to have inspired music. "Wrong-Way" Corrigan had his bard, no less than Lindbergh. And always somebody was around to opine musically about such disasters as the wreck of the dirigible *Shenandoah* in "The Hand of Fate."

The importance of music as a mirror of the times has been largely overlooked

The famous Anna Held helped make this old timer one of the better known flying songs.

in aviation. It remained for Mrs. Bella C. Landauer of New York, a veteran collector whose son is a flyer, to recognize it. She started her collecting 20 years ago, and in all that time she has scoured music shops, publishing houses, auctions and private musical collections for sheet music with an aviation theme in the lyrics or on the cover.

She got little help from clerks in music stores, who could usually remember "Come, Josephine, In My Flying Machine," but few other aviation songs. So she plugged along reading publishers' lists and personally inspecting old musical stock, building up a formidable list of items. Last winter she presented to the Institute a large part of her complete collection and thus made available one of the most distinctive features of aeronautical lore.

It is difficult to put a value on such a collection, but Maj. Lester D. Gardner, executive vice president of the Institute, says some of the songs are priceless because of their rarity, their age and their excellent state of preservation. "Many are songs of interesting words; some date back to 1785," the Major says. "Almost all languages are represented in the collection. Almost every cover in this collection has a lithograph, and from these pictures the whole history of aeronautics can be followed."

One never realizes until paging through the collection how closely love and aviation are related. But one can still rhyme "love" and "dove" in an airplane; "Balloon" goes perfectly with "June" and "moon," so we find a considerable proportion of the more modern music with an aviation motif concerned as much with love as with airplanes. Witness: "My Old Gal Done Flew," "My Skylark Love," "You Can't Walk Back from an Aeroplane, (So What Are You Girls Gonna Do?)."

The pioneer days of flying in the United States brought on a rash of music that will probably be remembered nowhere except in Mrs. Landauer's collection. In 1911, Alfred Levy wrote "Take Me Up in Any Old Plane":

My wife has got the aeroplane craze
I feel so very blue;
Since aviation's become a fad
I don't know what to do.
Just been married a couple of weeks
She swears she'll run away;
Someone surely is putting her wise
For all I can hear her say:

(Chorus)
Take me up in a monoplane, biplane or any old plane,
I want to go sailing through the air faster than any train.
If you've got a girl in the Emerald Green,
In a day you'll be there to kiss your colleen,
And the very next day at home you'll be seen
In the air in an aeroplane.

Like practically every air hero, Douglas Corrigan inspired at least this one song.

I wish the planes were running now
The same as 'lectric cars
And only cost just five cents
To ride from here to Planet Mars.
I'd be willing to let her fly now
If I had cash to pay
Then my troubles would be at an end
For all I hear night and day—(Chorus)

"Take Me Down to Squantum, I Want to See Them Fly" was written in 1912 for the Boston Aero Meet.

For two and a half centuries the musicians have been turning out lullabies, marches, polkas, two-steps, Schottisches, waltzes, dirges, gallops—there's even an aviation operetta—but by far the most celebrated event in aviation history was the flight of Charles A. Lindbergh to Paris in 1927. In the Landauer collection alone are 60 pieces of music written in ecstatic idolatry to Lindy. Only one, "When I Landed in Gay Paree (Oui-Oui)" relieved the emotions with a little gaiety. Some of the others, largely illustrated with lithographs of the *Spirit of St. Louis*, his plane, were: "Like an Angel You Flew Into Every One's Heart," "Lindbergh's Challenge," "Lindy, Youth with the Heart of Gold," "Lucky Lindy," "My Dear Old Plane and I," "Charley, Boy, We Love You," "America, Lindbergh Is Your Boy," "He Said That He Would Do It, and He Did!" If you'll slip back 14 years for a moment, you'll realize the music was a product of the hour; it is hysterical music that stemmed from a hysterical people. One of the Lindbergh songs titled simply "Lindy" was written in the Syrian language.

"Up in a Balloon" has been a favorite title for many years. The most famous was written by Leybourne in 1869 and it has been sung in many different versions to amuse theater and club audiences all over the world. The original sheet music carries both a "Gents' Version" and a "Ladies' Version," the difference being that the women would sing of a boy friend partaking in the adventures, while the men sang the first of four stanzas as follows:

One night I went up in balloon
On a voyage of discovery to visit the moon,
Where an old man dwelled, so some people say,
"Thro cutting of stick of a Sunday."
Up went the balloon quickly higher and higher
Over housetop and chimney pot, tower and spire,
I knocked off the city hall's top very nigh
And caught hold of the vane of Old South going by.

(Chorus)
Up in a balloon, up in a balloon,
All around the little stars sailing 'round the moon
Up in a balloon, up in balloon,
It's something awful jolly to be up in a balloon.

The lyrics continue to describe the voy-

(*Continued on page 98*)

"Katy" was inspired by such famed women flyers as Katherine Stinson and Ruth Law.

Engine check is of primary importance. Aeronca's Carl Friedlander (left) inspects one of his ships.

Keep Your Lightplane Airworthy

by J. H. DRESSEL

The 100-hour periodic check isn't enough. Plane owners should try the author's inspection plan.

THIS article is not intended for the purpose of depriving the certificated mechanic of any business but rather to give the lightplane owner and pilot some valuable pointers in visual inspection of his aircraft between the regularly required inspection periods. In addition, the author has attempted to include various and assorted hints on increasing the useful life of the conventional and increasingly popular "flivver" plane.

Although to many plane owners it may seem that life is complicated with the responsibility of all too frequent inspections, many things can happen to cause an airplane to lose its airworthiness between the regular 100 hour periodic checks required by the CAA.

As an example, take the case of a central Illinois lightplane owner (an acquaintance of mine) who loaned his ship to a friend for a private pilot's flight test. All went well until the first spin was attempted and off came the fabric from most of the upper surface of the right wing. The pilot was able to make a crash landing, saving himself from injury but unfortunately the plane was a total washout. Cause: field mice had eaten the rib stitches out of the entire structure and made them into neat little nests in the trailing edge of the wing.

Simple visual inspections of the airplane at frequent intervals can and will prevent the possibility of such mishaps without adding a cent to the upkeep of the airplane and in many instances will reduce this cost a great deal. It is recommended that an inspection of the type outlined below be made by the owner-pilot regularly, and particularly before the airplane is flown after having been hangared for an extended period. One of the better airplane insurance companies furnishes inspection forms, especially designed for use by lightplane owners. These forms are supplied free of charge and their use is very advantageous.

Start with the engine—be sure the switch is off and pull the prop through to check compression. In any four stroke cycle engine, all of the cylinders fire in two complete revolutions of the crankshaft so, unless the propeller shaft is driven through a gear reduction, a compression point should be reached every 90° the prop is revolved in the conventional four cylinder lightplane engine. If the compression in all cylinders is approximately equal and seems normally high—all well and good, but if the prop "slides by" one or more of the points, trouble is indicated in the form of leaking valves or piston rings. When compression troubles are found the engine should be warmed up and a good top cylinder oil injected into the carburetor air scoop while the engine is running. After giving the oil time to do its work of dissolving carbon and freeing gummed parts shut the engine down and re-check the compression. If the trouble remains, the engine should be given immediate attention by a certificated engine mechanic.

Continuing with the engine inspection, check the oil for condition and amount. Never make the common error of using an oil several grades heavier than that recommended by the manufacturer as this is at the bottom of many serious

engine troubles. Check for excess oil leakage and wash the engine down if it is dirty. If the front thrust bearing is throwing oil, make sure the crank case breather is free of sludge as this is a common cause for the trouble.

Go over all fuel and oil lines looking for chafed areas, deteriorated hoses and oil leaks. Drain the fuel strainer and replace its gasket. The ordinary light plane fuel strainer with a glass bowl uses the same size gasket as most automobile fuel pumps and may be obtained for a few cents at any auto supply house. Pay particular attention to the rubber mounting pads on the engine mount and have them replaced when they begin to look ragged.

Keep a careful check on spark plugs and spark plug cables. Whenever the spark plugs are replaced use only the exact type recommended by the manufacturer as a change in heat range will invite either pre-ignition or fouling. If the ignition system is kept good and clean, you never need fear that even a heavy rain will cause the engine to cut out. Spark plug wires have a tendency to fail where they are held in place by metal brackets and it is a good idea to slip the wires one way or the other to inspect this critical area. Make sure that the magneto ground wires are tightly connected and in good shape as a failure in this circuit leaves the magneto "on" regardless of switch position and turns even the smallest of aircraft engines into potential "killers."

The bolt connecting the carburetor throttle arm to the throttle shaft works overtime and should be replaced whenever wear is evident. Weather conditions cause the idle speed of an engine to vary somewhat and will make adjustments necessary from time to time. Be sure the setting will allow the engine to idle at a speed where it will not die in long glides. CAA or factory bulletins specify the correct revolutions per minute for each type of equipment and an adjustment should only be attempted after the engine has been brought to operating temperature as the idle speed will increase considerably as the lubricating oil warms up. After making an adjustment of the idle stop, care must be taken to see that the lock screw is firmly tightened. Watch the carburetor carefully for leakage and should it be present have the needle valve and seat replaced at once as nothing is a greater fire hazard in the hangar than a ship that constantly drips gasoline.

When flying in cold weather several special precautions should be taken. If the temperature is extremely low, all external oil lines should be lagged with asbestos and tape. This is also advantageous in the case of flexible tube crank case breathers to prevent the freezing of vapors with resultant stoppage of the tube. Above all things see that the carburetor heater is in operating condition and that its butterfly valve shaft is not worn to a point where leakage is excessive. Keep the fuel tanks full when the ship is not in use as this will prevent condensation and the forming of moisture on the inner tank surfaces. Exhaust pipe

(*Continued on page* 90)

The Man Who Carries the Ball

by Brig. Gen. M. F. SCANLON

Key man of striking force, the bombardier is mainspring of offensive aerial warfare.

LONG overdue, wider recognition is on the way for the man around whom the nation's rapidly increasing aerial striking power is building. He is the bombardier, possibly the most important link in the whole chain of the war effort.

In Britain the man who aims the bombs to score a bullseye on a German pocket battleship or munitions plant is no longer an unsung hero. There was the keenest competition in the RAF for the record of putting the *Scharnhorst* and *Gniesenau* out of action. "Butt End Charlie," the rear gunner of the RAF, shares likewise in the glamor which has so long attached to the combat pilot.

In the U.S. Army Air Forces, the bombardier was just beginning to win the recognition to which he is entitled when the country was suddenly plunged into war. He is fated inevitably to take a larger share of the spotlight as production of bombers mounts and the Air Forces expand into the powerful and victorious military instrument they are destined to become.

Why the pilot thus far has had almost a monopoly of attention in military aviation is due to a combination of circumstances, which include human nature. Flying until recent years was in its infancy, with the result that it was a distinction merely to operate a plane. The 1914-18 World War made the fighter pilot a knight errant, heir of the age of chivalry, the warrior of single combat in a day of mass slaughter. Inevitably he held the spotlight.

Only in the last year or two has there been a bombardier as such in the Army—indeed it was only about 1935 that his descriptive designation was coined by Lieut. Col. Kenneth Walker. Now, however, with aviation come of age, the pilot must surrender much of his relative importance to the new key man of the striking force.

The bombardier in action commands plane from exposed position in front "blister."

It has been said with much point that "the bomber is the backbone of the Air Force," and it is just as true that both the backbone and brain of the bomber is the bombardier. Congress has voted billions of dollars for Army aviation, factories are setting new production records and a vast number of pilots and mechanics are being trained, all essentially to one end—that the man behind the bomb may be able to place it on a vital enemy target.

The bombardier's role is especially important in the U.S. Army Air Forces, with our stress on long range, high altitude precision bombing, in contrast with the mass dumping of explosives exemplified by the *Luftwaffe's* attempt to reduce London to rubble.

In essentials, the bombardier's job is to compute when over the target all the data required to determine the exact point and instant to release the projectile. During the period when runs are made over the objective, he is in command, whether his ship be a multi-engined craft with a crew of seven or eight men, or a light bomber. He combines the functions of a battleship fire control officer and gun pointer, and corresponds as well to a field artillery battery commander.

Aside from the bombardier's role as "the man with the ball" when his team is on the offensive, there is another aspect of his function which should make a strong appeal to young America's sportsmanship as well as patriotism. He is a big game hunter whose quarry may be a battleship instead of a deer, his skeet gun a $300,000 weapon, its trigger the world's greatest bomb sight.

The vast and urgent expansion of the Air Forces which was in swing before the war emergency has opened a wide vista of opportunities for the man behind the bomb sight. A large proportion of the new airmen trained are to be bombardiers, each the product of some of the most intensive training undergone by any member of the air team. In some respects the intention is that he shall be the pick of the crop of embryo airmen. In general, the man who makes a good pilot makes a good bombardier, but some special qualifications are desirable.

The war's sudden impact forced an immediate restudy of original training plans, but no developments in sight can diminish the vital importance of the bombardier.

END

PHYSIO FLIGHT

by Lieut. T. C. GILLMER

Flying has had many unusual effects on the human body, opening new fields of physiological research.

MODERN air transportation is comfortable—as comfortable, if not more so, than any other means of getting about. Riding the skyways regularly, however, either from the duty standpoint or for sheer enjoyment, brings the elements and physical limitations to a more poignant realization.

A pilot's sensations in day-to-day flying may become so commonplace as to be unnoticeable. In more extraordinary maneuvers they are shaken off or of such momentary duration that they are disregarded. On the other hand, new pilots continuously experience sensations that may confuse and limit their flying ability. High speed military craft and military flying often cause physical limitations to be reached before the plane's ultimate performance is accounted for. In any case, a sound understanding of bodily reactions and physical limits—heretofore a study limited to medical journals and for flight surgeons—should become a part of the pilot's basic knowledge. He then will be in an immeasurably better position to co-ordinate his own and his plane's performance.

The human body fundamentally was designed to operate under limited natural conditions, involving a relatively small range of temperature, atmospheric pressure, atmospheric content and uniform motion, with slight acceleration and deceleration. All these conditions are magnified when we ascend to flying altitudes and dive and turn and spin in a rarer and colder atmosphere. Consequently, some means of control, either conscious or subconcious, must be assumed. Otherwise we are riding with disaster.

Some physical reactions' control is easy; others are extremely difficult and a few even must be avoided. The causes of the sensations and reactions may be summed up as follows:

1. Motion	2. Atmospheric Changes
a. uniform	a. cold
b. turbulent	b. carbon monoxide
c. accelerated	c. altitude

The inherently graceful motions of the plane make the airliner most comfortable form of travel.

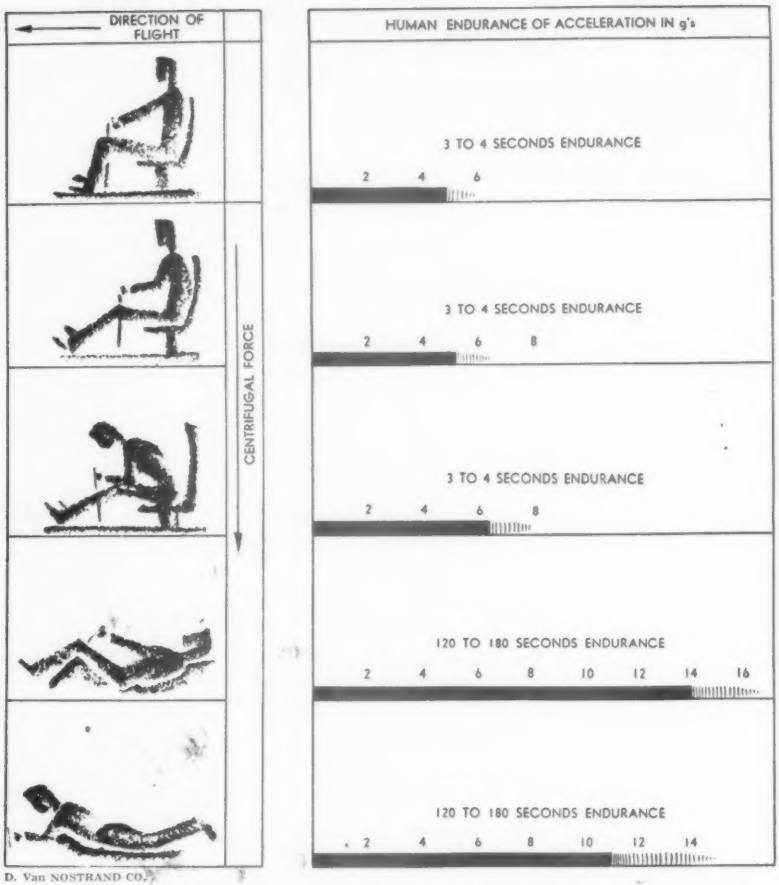
The results or sensations themselves may vary from immediate loss of consciousness with possible injury to internal organs, to illness, serious impairment of judgment, loss of orientation, or mere discomfort.

Motion, if uniform, has no effect on the plane's pilot or other occupants. This, of course, refers to uniform, straight line motion. Turns will affect the pilot if they are rapid, especially those resulting in centrifugal force, which causes a marked added weight to the arms and legs. In rapid turns occasioned by spins the pilot should control any dizzy or giddy feeling by imitating a toe dancer who looks at only one object during a complete revolution. Any dizziness acquired in a spin can be dispelled by a vigorous head shaking.

The reasons underlying these reactions, like many other sensations in flight, are found in the nerve centers between the eye and ear. This balance organism in our head, just as in the case of the ball bank indicator, cannot differentiate between the force of gravity and centrifugal force. The eye, our most important organ for determining position in space, cannot be relied upon when flying "blind"; although no difficulty may be experienced on straight and level flight, a turn cannot be distinguished. Instruments, therefore, always *must* be the sole guide in such flight. The pilot must learn to cut loose 100 per cent from all sensations.

Turbulence can give rise, in susceptible people, to a condition similar to seasickness. Many flyers may never experience such airsickness, yet others with many hours of flying may never fully overcome the tendency. The general conditions of the pilot play a big role in this malady, as does lack of sleep, empty, full or disordered stomach; or flying after drinking liquor. Any lack of physical fitness is an intolerable condition and the resulting limitations are not confined to turbulent flying alone. The well-disciplined pilot will treat his body with the reverence devoted to any of the plane's vital parts. Regular exercise, temperate habits and all around good living will pay large dividends. A resistance to air sickness usually can be acquired by repeatedly flying in rough weather.

Acceleration or deceleration (negative acceleration) is the result of changing either the magnitude or direction—or both—of velocity. This is the scientific definition. In flight, acceleration is spoken of most consistently in terms of "G's"—that is, the number of times the value of the acceleration due to gravity


DIRECTION OF FLIGHT
CENTRIFUGAL FORCE
HUMAN ENDURANCE OF ACCELERATION IN g's
3 TO 4 SECONDS ENDURANCE
2 4 6
3 TO 4 SECONDS ENDURANCE
2 4 6 8
3 TO 4 SECONDS ENDURANCE
2 4 6 8
120 TO 180 SECONDS ENDURANCE
2 4 6 8 10 12 14 16
120 TO 180 SECONDS ENDURANCE
2 4 6 8 10 12 14
D. Van NOSTRAND CO.

Tests have shown that certain postures increase pilots' acceleration endurance in power dives. Most favorable position proved to be that shown second from the bottom.

alone, "G" being referred to as the value of the force exerted on the body by gravity. In various maneuvers it is common that accelerations should exceed that of gravity acceleration.

The acceleration of a catapult start is between two to four times the amount of the earth's acceleration (2 to 4G) and lasts about 0.8 to 1.5 seconds. The centrifugal forces set up by tight vertical banks may be up to 5G. Pulling out of dives can easily exceed this figure. If this lasts several seconds "blacking out" occurs when the pilot suffers sudden loss of sight. He remains, usually, fully conscious but has the sensations of an opaque fog or veil over the eyes, which disappears as soon as G is reduced. Short periods of loss of consciousness are rare, but have been noted. Such visual disturbances are dangerous in races on rounding pylons. Also, needless to say, are they dangerous in stunting at low altitude. During pullouts in dive bombing and in tight banks during aerial combat, it is especially inopportune, as the blackout may occur just as the objective appears in the gunsight.

This condition is caused by the centrifugal force opposing the normal circulation of the blood to the brain and to the retina of the eye. For example, the blood pressure in the cerebral arteries sinks from 120 mm. of mercury (normal) to five or 15 mm. of mercury. Disturbances of vision usually occur at about 4½G. Here again, after indulgence in alcohol loss of consciousness is quick to occur at about 5G and does not return when the excessive G's are removed as is normally the case.

Has the pilot any control over "blacking out" or suffering some ill effects from excessive acceleration other than avoiding maneuvers tending to cause it? Fortunately, certain positive control may be exercised, since the direct cause is centrifugal force literally drawing the blood out of the upper portion of the body and preventing circulation to the bodily control center. Thus, when a plummeting elevator stops, a passenger's body ceases to move, but the less restricted blood in the veins may tend to continue downward due to inertia. The posture assumed by the pilot during maneuvers, therefore, has a marked effect in counteracting the harmful effect on circulation. Any position making the body more perpendicular to the direction of acceleration will restrict the blood flow's inertia more surely, allowing it to remain in its normal condition (see sketch). Consequently, by assuming various advantageous positions, greater G values for longer periods can be endured. Crouching with chest on thighs, head held upright, looking straight ahead, enables a pilot to stand six, seven and even eight G's for periods of three to four seconds. The most logical position for pulling out of dives would be absolutely prone, preferably on the back. The endurance of G's and period of duration in such position is remarkably increased (see sketch).

Collapsible "barber" chairs might yet serve a purpose in dive bombers. Over 10G, the effect on the human system becomes dangerous and should be avoided.

The above holds true only for normal flying. In inverted flying (such as forward or inverted spinning) the blood is forced into the cranial cavity and may cause blood vessels to burst due to sudden increased pressure. To try to assume a bodily position perpendicular to the direction of the acceleration theoretically remains the solution. It would be difficult practically, though, to continually adjust the posture to changing flight direction. Therefore, in inverted flying during acrobatics, 3G should not be exceeded. Loss of consciousness occurs at 3.5G; hence the absolute necessity of a gentle hand during inverted flying maneuvers. Changes in the condition of the atmosphere account for considerable of the sensations experienced.

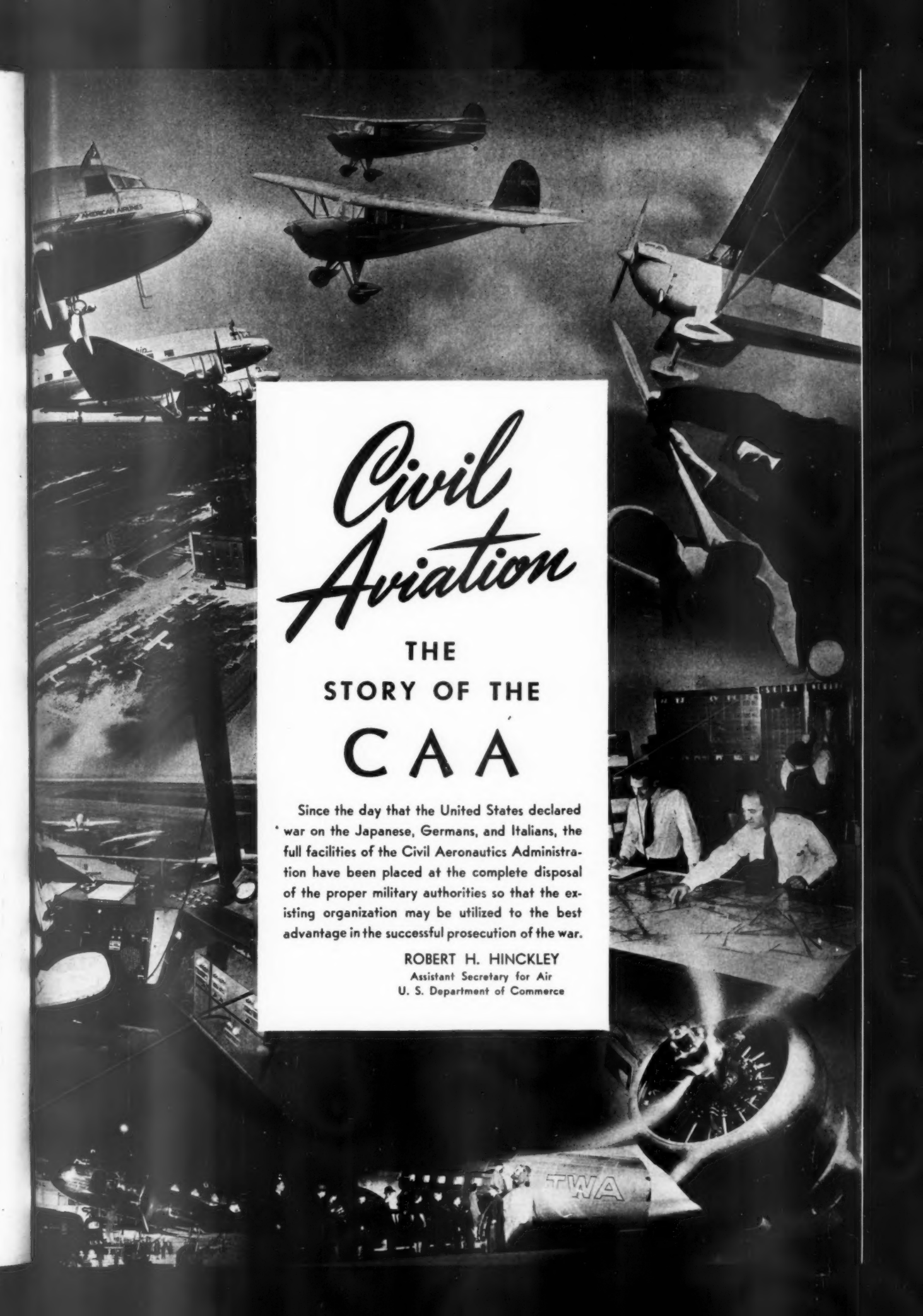
Temperature, pressure or oxygen ratio of the atmosphere bring noticeable bodily reactions. A numb, half frozen pilot cannot operate as efficiently as a comfortable one. Both bodily reaction and muscular control are slowed down. This sort of cold due to high altitude or, to use the meteorological phrase, "lapse rate," is not always to be coped with by the addition of more clothing. In atmosphere with a decreased oxygen content the loss of heat from the lungs alone is greater than body heat can furnish. Consequently, high altitude flying requires some form of artificial heating, either in cabin or flying suits.

It is vital that the pilot inhale no exhaust gases. This is especially important during altitude ascents, as the engine, owing to incomplete combustion, produces a large percentage of carbon monoxide, rendering the exhaust gases especially dangerous. This is aggravated by the fall of oxygen pressure due to rise in altitude and to the 310-times-greater affinity for hemoglobin of carbon monoxide over oxygen. It is a frequent headache cause and the pilot's suspicion should be aroused if an altitude flight's effects do not wear off quickly.

At sea level, the atmospheric pressure is, on the average, 30 inches of mercury, hereafter referred to by its symbol, Hg., or 760 mm. Hg. At all atmospheric levels oxygen makes up about 21 per cent of the air. The bulk—78 per cent—is nitrogen. This gas and argon (about one per cent) constitute the inert gases. A small amount of carbon dioxide is present (0.03 per cent). This is the air we inhale. As oxygen is absorbed by the lungs and carbon dioxide is given off, the air in the lungs contains close to 5.6 per cent carbon dioxide. The air there also is almost saturated with water vapor.

The oxygen requirements of the body's blood and tissues depend upon the oxygen pressure of air in the lungs. Available at sea level is 109 mm. Hg oxygen

(*Continued on page* 110)



Civil Aviation

THE STORY OF THE CAA

Since the day that the United States declared war on the Japanese, Germans, and Italians, the full facilities of the Civil Aeronautics Administration have been placed at the complete disposal of the proper military authorities so that the existing organization may be utilized to the best advantage in the successful prosecution of the war.

ROBERT H. HINCKLEY
Assistant Secretary for Air
U. S. Department of Commerce

Win This War

by

JESSE H. JONES

Secretary of Commerce

THE immediate thing is to win this war.

In the pages of this section will be found descriptions of the functions and the planning of the Federal Government's agency to foster and develop civil aviation.

After this war, the Civil Aeronautics Administration will face the tremendous task of helping to convert our vast wartime aircraft industry—with its billions of investment and its million trained workers—to civil and commercial uses. That will be a tremendous task and perhaps the reader will find evidence in these pages that a sound groundwork already has been laid for this planning.

But today, and for the duration, we dare think only of how civil aeronautics can contribute in the most effective way to an early victory. For the quicker we can win, the sooner we can think again of the sort of life we all want most—a life of free and peaceful commerce.

Aviation in the U. S.

"Air conditioning" America will pay as many dividends as did the breakdown of antagonism to the automobile.

by

Robert H. Hinckley

Especially noted for his sponsorship and early direction of CPTP is Mr. Hinckley, now Assistant Secretary of Commerce for Air. Born at Fillmore, U., June 8, 1891, he was graduated from Brigham Young University in 1916, later served as member of Utah state legislature. In 1939 Mr. Hinckley was appointed chairman of the Civil Aeronautics Authority.

THE United States had the first motor-powered wings in the world. The airplane is almost as old as the automobile. Almost any person in his 50's can remember when each was an astonishing novelty which drew throngs of gaping spectators. Yet the automobile has been considered virtually a family necessity for more than a decade, and its qualified operators number more than one-third of the adult population, whereas the airplane remains a somewhat awesome mystery to perhaps 19 out of 20 of our adults, and the number who can operate one is only an infinitesimal fraction of one per cent.

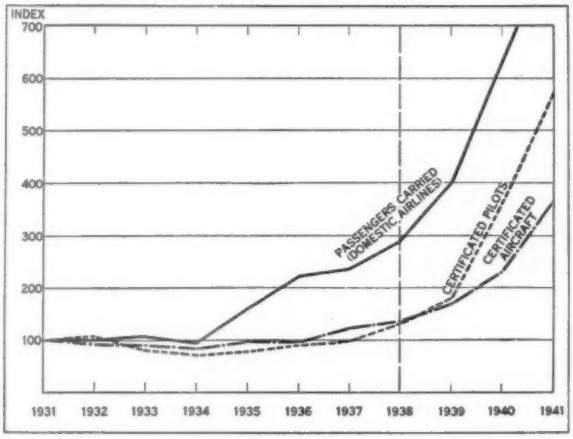
The great disparity between the relative speeds with which these two types of transport have developed is, of course, a compound of many reasons. The motor car took man into no new element. However loudly the sidewalk yokels might shout, "git a horse," the tires rested solidly on good old terra firma. Too often, in fact, they sank hub deep into the mud or sand; but that was nothing which good roads could not cure, and all the agencies of Government set to work promptly and vigorously to do so.

There were 100,000 motor cars in 1906. Road-building with local funds contributed importantly to the fact that auto registrations passed 1,000,000 in 1913, and were well over 3,000-,000 by 1916. At this point Federal highway aid was begun, to promote interstate roads for commerce and defense. In the intervening 25 years more than six and one-half billion dollars in Federal funds have been alloted to roads and streets. Combined with local money, the grand total is somewhere between 25 and 35 billions for roads and streets, and this is the principal reason we have some 28,000,000 motor cars today.

I do not in any sense deplore this. It built the greatest consumer-goods industry ever known; and contributed vastly to nearly every phase of American life, from heavy industry through retail sales to culture. My point is merely that large-scale support, with public funds, was a major factor in the automobile's development.

While the automobile thus wormed itself into nearly every American's life, where was the airplane? Until quite recently it remained a spine-chilling novelty in which a few daredevils risked their necks at county fairs to thrill crowds or morbid curiosity seekers. When we entered World War I there were, at best estimates, only a few hundred aircraft in the United States. That war left us with a few thousand, mostly designed for military instead of civil use, and the crash-record they piled up in the hands of the barnstormers and amateurs certainly was not calculated to inspire in "Aunt Hetty from Dubuque" an irresistible urge to fly. On the contrary.

Chart shows upward surge of all civil aviation activity.



But our technicians, the best in the world, kept endlessly at the task of safer, more economical flying. Through the '20's and into the great depression they struggled, undergoing severe hardships but laying the groundwork for the best aircraft, light or heavy, in the world. Nevertheless, they did not catch the American public's fancy. Even in the boom days of 1929, there were less than 7,000 registered aircraft and only 10,000 pilots; and in that entire year our airlines had less than 160,000 passengers.

Aviation needed the support of Government, just as every other type of transportation had needed it; but there were few city councils, county boards or State Legislatures willing to view it, yet, as a means of general transport.

Not until 1926 did the Federal Government create any special machinery to assist civil flying; and this agency was so limited and inadequate as to do little more than set a precedent for the things to come. Many of those precedents were sound, but the agency had little power and less money. The details of this struggle are told elsewhere in another article by a career man who went through them from the very beginning—Charles I. Stanton, now Deputy Administrator of the Civil Aeronautics Administration.

The passage of the Civil Aeronautics Act of 1938 gave the Federal Government its first adequate civil areonautics agency. As a charter member of this body I saw it move swiftly to the various tasks which had been skimped or neglected in this country for 20 or 30 years. The airlines were given a solid foundation on which to develop, without suicidal competition and with adequate public support. Safety regulations were strengthened and enforced. Communications to increase safety in flying were improved and extended. And finally, a widespread program of aviation training was fostered in the colleges and universities, the greatest program of its type ever achieved by any free nation.

The Federal machinery to encourage the development of civil flying was further strengthened in 1940 when President Roosevelt moved its administrative functions back into the Department of Commerce without impairing the independence of its judicial and legislative function.

This move engendered bitter controversy at the time, but I believe the 18 months which have intervened have proved its wisdom. Certainly many of its bitter foes have revised their opinions in the light of the facts. For one thing, the reorganization resulted in a much closer working relationship between the CAA, the Weather Bureau and the Coast and Geodetic Survey, not to mention the Bureau of Standards. For another, the CAA obtained a voice at the Cabinet table which previously it had not had; and whereas it had not received any appropriation for airport construction during the previous two years, it has received $140,477,750 in such appropriations since.

Even if the current emergency had not arisen, 1938 would mark a turning point in this country's civil aviation. As late as 1937 there were only 9,000 planes and 17,500 pilots. But by that time over $300,000,000 had been invested in airports,

(*Continued on page* 65)

The CAA

How the United States has created a regulatory organization to supervise civil aviation and "Keep 'Em Flying" in safety.

by Brig. Gen. Donald H. Connolly

Particulary well-fitted for his duties as Administrator of Civil Aeronautics in this war emergency, Brigadier General Connolly graduated from the U. S. Military Academy in 1910, rendered distinguished service in World War I, later served on the General Staff. He was selected as CAA Administrator in 1940 and, in 1941, was advanced to brigadier general rank.

UNDER a recent executive order the facilities of the Civil Aeronautics Administration directed by the Secretary of Commerce are to be operated to aid in the successful prosecution of the war effort as may be requested by the Secretary of War.

Many of the responsibilities of the CAA are essential to that war effort and key personnel should feel that the duties in which they are engaged in carrying on these operations represent a direct contribution to the war effort.

When the armed services feel that the need for the services of such personnel is acute, that personnel will be called.

By the same token, civil aviation, in common with everything else in the country, must dedicate itself to go down the line in the way that will contribute most to furthering the war effort.

With these premises, the following outline of the duties of the CAA—and how those duties affect civilian flying—has been prepared.

Look skyward, and each airplane you see has been—or should be—licensed by the Federal Government.

Its pilot is similarly licensed.

Both have been Federally checked and re-checked in the course of their progress from earth to air, and both have to be checked and re-checked periodically to establish their continued airworthiness. The mechanic who takes care of the plane also carries a Federal certificate of approval. Just as the pilot must observe certain Federal regulations to insure his safety and the safety of other flying craft and personnel, so also must the mechanic keep up to a high standard.

There is a moral to this. The moral is that because of the care with which it is operated, U. S. civil aviation is the largest, fastest growing and safest in the world, and therefore ready and able to contribute its utmost in aiding the armed forces in the total war effort.

"Keep 'Em Flying" is not merely a motto with the Civil Aeronautics Administration, nor with the civil aviation industry or with U. S. civil pilots. It is a way of life.

The story of how this has been brought about is the story of the development of civil aviation in the United States and the part played in that development by the CAA.

Let us consider it step by step, first as it concerns the pilot, then as it concerns his plane and its operation.

You are, let us assume, a layman who wants to learn to fly. If you are between the ages of 19 and 26, there is the possibility that you may do this without any but nominal cost, by qualifying for a Civil Aeronautics Administration pilot training scholarship.

But whether the novice is fortunate enough to get into a CAA training program or gets his training elsewhere, he will find CAA and safety everywhere he turns. He must pass a physical examination to determine whether he has proper health requirements for flying. He must go to a Federally licensed training school and fly in a Federally licensed plane operated by a Federally licensed instructor. The ground school course which he takes must also pass certain Federal requirements for equipment and teaching personnel. When he takes the test for his license, he must get the approval of a CAA flight inspector.

The airplanes he uses have gone through a similar system of checks and double-checks. Manufacturers must get CAA approval on blue prints before they build ships for public sale. Once the ships are built, they must be flight tested and approved, and further checking is necessary at the end of a specified number of hours in the air. This also applies to engines, propellers and other equipment.

To get his license a pilot must be familiar with Federal air regulations, all of which are designed for both his safety and the safety of others who fly. To keep it he must observe these rules, which are promulgated by the Civil Aeronautics Board and enforced by the Civil Aeronautics Administration. If he should get into the airline business, he may have more to do with the Board, which authorizes routes, sets compensation for carrying mail, and handles other economic problems of scheduled aviation. But most of his aviation contacts are likely to be with the Civil Aeronautics Administration.

In planning his flight, he will first consult the latest bulletin published by the CAA Information and Statistics Service. It will tell him where anti-aircraft gunnery practice may be creating a danger area, where construction work is making an airport temporarily unavailable, and other important facts.

If he makes a flight of any distance, it will probably be over a route which forms part of the 35,000 miles network of aids to navigation known as the Federal Airways. This system, built and operated by the CAA, will provide him with weather information, traffic guidance, radio course signals, obstruction markings, lighted emergency landing fields and other necessary services.

The airport where he lands or takes off may be one of the more than 350 built or improved in the CAA defense landing areas program, for which over $140,000,000 has been appropriated thus far.

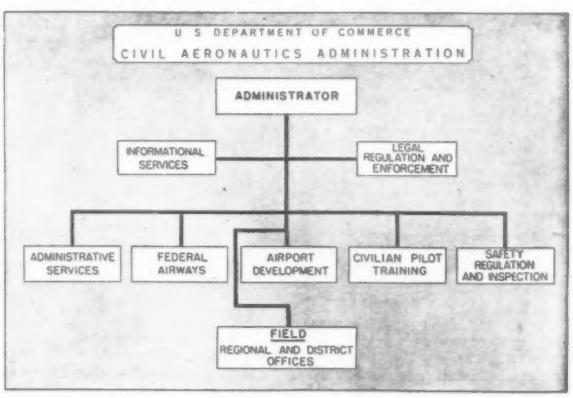
Having completed his flight, he logs his time against the day when a CAA inspector will check his application for renewal of his pilot certificate.

Possibly this might seem to add up to a gigantic bureaucracy, but actually the effort of the CAA has been to decentralize the entire process, and keep itself geared to the speed of planes themselves. Pilot training is assigned to the colleges and flight schools of the country; CAA-built airports are turned over to local government units for operation; and much of the tremendously increased volume of aircraft and airman examinations is carried out by accredited volunteers from the industry.

Thus the CAA does its part to make the motto "Keep 'Em Flying" a permanent part of the American way of life.

END

Chart shows simplicity of CAA executive department setup.



FOR SAFETY

Testing everything from pilots to giant transatlantic planes is all in the day's work for seasoned inspectors of the CAA.

by
A. S. KOCH

More than 10 years of service in Federal agencies governing civil aeronautics mark the record of Mr. Koch, now CAA Director of Safety Regulation. An Army pilot in first World War, he was with automobile industry prior to entering commercial aviation in 1928 as manager of Mohawk Aircraft Corporation. He was born September 16, 1893, in Chicago.

YEAR after year, since aviation began, flying has become safer. The American people have come to expect that figures on safety in airline flying, private flying and student training will be better this year than last.

I am asked frequently if the CAA is not proud of this record. It would be very flattering to Safety Regulation to have the credit for producing so much safe flying, but the credit is not ours. The CAA can well be proud, however, of the staff of Safety Regulation because, with few exceptions, every member is an experienced and skilled worker in his particular specialty. In promoting safety, I would be likely to ascribe more importance to experience than training, and the men in charge of the Air Carrier, General Inspection, Aircraft Engineering, Flight Engineering, Factory Inspection and Medical Divisions qualify because they have all been in aviation for years.

W. T. Miller, Fred M. Lanter, Marion P. Crews, Charles F. Dycer and Dr. W. R. Stovall who head these divisions are not only experienced in aviation, but they know how to pick their assistants from the industry and out of positions where their experience has qualified them. It takes more than a well-trained man for these jobs, because our personnel are educators and safety engineers and not just enforcers of the law. These are the men who meet the flying public, who interpret the CAA's regulations to the aviation industry. These are the men who guard the pilots and planes in which America flies.

They are certainly not the only answer, however, to the question of why we have flown so safely. They are one of the two big answers, because the CAA Safety Regulation has settled into a steady gait that, year after year, does its part in safety education and accident prevention.

But there is another important reason. Flying today is "in the groove." There were, as of October 1, 1941, 184,500 men and women, boys and girls in this country who were pilots; that is, who had either pilot's certificates or were learning to fly on student's certificates. Also, there were some 13,000 certificated mechanics, as well as a large number of ground instructors, parachute riggers and the like. These are the friends of flying, its best protectors, guardians of flying whether it is their business or their hobby.

The friends of flying have done the biggest job. Just recently, when Safety Regulation found itself falling behind in its work due to the ultra-rapid growth of aviation, we turned to these friends for helping hands. We found 700 pilots, mechanics, instructors and others willing to serve in honorary capacity as aircraft inspection representatives and flight examiners. These are well-qualified, experienced people who are not paid even a dollar a year, but who do some of the work of inspectors when inspectors are not available. Thus far, as a whole, they have proved the wisdom of our appointing them. They were of invaluable help when war was declared.

Test Pilot Eddie Allen (left), and CAA flight test board executive J. E. Boudwin, in Boeing Pan American Clipper.

Plane's life is carefully recorded on proper CAA forms.

Streamlined loop antenna is one feature of CAA's Douglas DC-3, used for aerial laboratory and technical training.

Airport beacons are useless unless kept in A-1 condition. Here one is carefully checked by CAA, following repairs.

General inspectors must approve for certification not only pilots but also mechanics planning career in aircraft work.

Boeing, Pan American and CAA officials confer in Clipper control room. Note commodious work space for flight crew.

The aeronautical and aircraft inspectors of Fred Lanter's General Inspection Division are the main beneficiaries of this volunteer help. The job of General Inspection is to examine applicants for pilot's licenses, give them flight and written examinations; inspect aircraft for airworthiness certificates and to give practical and written tests to mechanics and all other certificated airmen. These are the busy "Dutch uncles" of private flying of the CAA force; men who cover large areas of the regions in which they serve, appearing on schedule at various fields where applicants for certificates and owners of planes meet them for their examinations and inspections. They are the best friends of all who behave themselves in aviation and they are the confidants and advisors of the young pilot. There are 383 of them, and, with the 700 volunteer helpers, they are today giving service to the industry such as was never available before. The partnership is working swell.

These inspectors are the men who come closest to the general public in aviation. Not a pilot has a legal right to take to the air before he has come under the eyes of a CAA aeronautical inspector. Not only has each young pilot convinced the inspector that he is a competent flyer by actually going through a series of flight maneuvers, accompanied by the inspector, but he has proved he knows what all pilots should know by passing an examination on navigation, engines, aircraft, meteorology, radio and the Civil Air Regulations.

These are the men who, day after day, visit the airports of the country and observe the kind of operations that go on. In fact, they look with the eye of the experienced airman—which each of them is—at what kind of aviation is on sale at America's airfields. Every one is a qualified Civil Service public servant, selected from the ranks of the industry itself and deeply impressed with the duty to "Keep 'Em Flying."

In the Air Carrier Division headed by Bill Miller, a staff of inspectors work with the airlines. There are three kinds of inspectors here, specializing in maintenance, operations and radio. Generally they are stationed at the points where airlines have their headquarters, but they get about the world to wherever United States airlines extend their services. Some are stationed in Panama, Honolulu, Alaska and several points in South America. Soon there will be others at Accra (on the west coast of Africa).

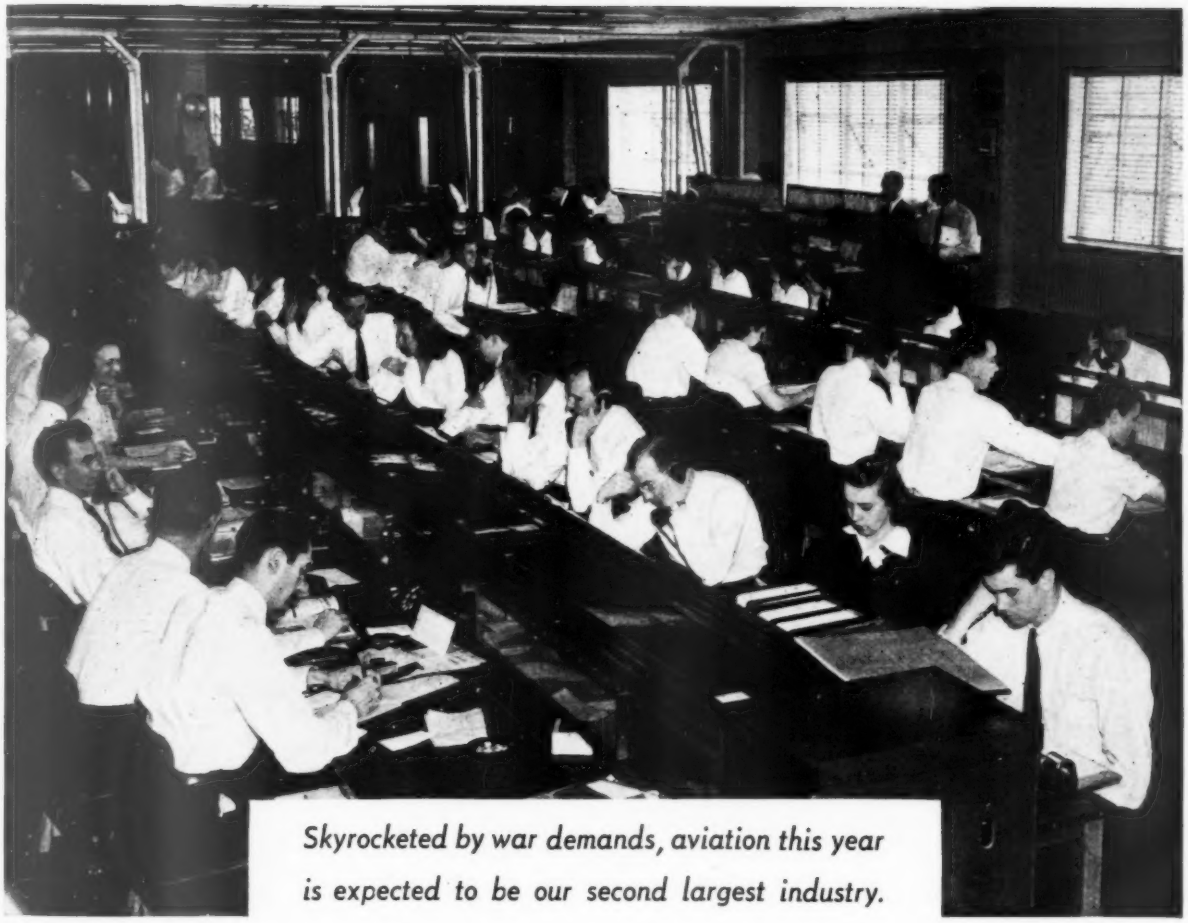
After years of experience and co-operation between the CAA and the airlines, the work of these inspectors resembles more a continuous conference with the responsible airline officials than the patrolling of a beat to see that regulations are observed. The air carrier inspector is a human clearing house of good ideas for safety in airline operation. Nothing is so jealously guarded by the airlines as their records of safe operation. This is their best piece of advertising copy to the people who have not yet started to travel by air. Their partnership with the CAA has returned dividends in long accident-free periods of operation resulting from what they have all learned about the best way to operate an airline.

The work of the Air Carrier Division, as well as the General Inspection Division, is much more than inspection. It is more than policing, although writers persist in making that comparison with CAA inspectors. In these two Divisions of Safety Regulation the work is largely educational.

In Mr. Crew's Aircraft Engineering Division and Dr. Stovall's Medical Division, the emphasis shifts to prevention. How much flying owes to the work of these engineers and doctors is difficult to estimate since most of their results fall into the realm of the future.

In the Aircraft Engineering Division is where the airplane starts its life. When its proud parents have decided what it is to look like, what it is to be made of, what it will do in the way of speed, range and lift, they submit their drawings and stress analyses to the engineers. These men, schooled in the technical aspects of structural integrity and design, with volumes of specialized information at their elbows, go into all the details with the fine-toothed comb of experience. Unless the structure of the plane is a radical departure from the orthodox, they can decide from examination of these data whether it will be safe. They may, however, require that the manufacturer conduct special tests of specific parts of the

(*Continued on page* 64)



Skyrocketed by war demands, aviation this year is expected to be our second largest industry.

Flying is a Business

by
CHARLES I. STANTON

Deputy CAA Administrator, Mr. Stanton was born in Medford, Mass., July 28, 1893. He was graduated from Tufts College in 1917, joined Air Corps and was assigned to radio development flight duty. After the war he became assistant general superintendent of U. S. Air Mail Service. He has served since 1927 in Federal civil aviation departments.

FLYING is a business. Until comparatively recently, it was the most misunderstood business in the country. But it was rugged—and typically American—so, like a lot of other rugged Americans, it grew to become the pride of the country.

This may seem like stating the obvious, and perhaps it is, for according to authoritative predictions, aviation is scheduled, among other things, to be the second largest industry in the country this year and, in the light of our entry into the war, it is certainly one of the most important in the world today.

But it is significant as well as obvious when you get down to cases, and I am going to cite a few of many because I know that they will find a sympathetic response from those who are flying the "putt-putts" today. They, too, know that flying is a serious business—and most of them have experienced the difficulties we had, 20-odd years ago, getting that idea across to the general public.

Twenty-odd years—and yet it represents something which seems not far from a century of progress. I remember when I got out of the Army air service in December, 1918—and signed up for work in the Post Office Department's air mail service on the following day. As a boy I had avidly read all I could find on the "early bird" stage of aviation—the years that Harold H. Strickland calls "the days of sheer nerve." The feats of the Wrights and their followers, Brookins, Hoxey, Johnson, Coffyn, Curtiss' capture of the Gordon Bennett trophy, his historic flight from Albany to New York to win a $10,000 prize, the accomplishments of Beachy, Ely, and our early foreign visitors, Grahame-White, Paulhan, Sopwith and others—these were things as familiar to me and scores of other flight-crazy youngsters of the time, as building flying models is to the youth of today.

As an Army flyer, I had become familiar with the Curtiss JN's (the famous Jennies) and the De Havillands, the notorious "flaming coffins"—which, nevertheless made air mail practicable—powered with Curtiss OX-5, Hispano-Suiza (Hisso) and Liberty engines, all destined to be the backbone of aviation during the seven lean years following the war.

I knew nothing about navigation instruments nor airways, because there weren't any; nor much about airports, of which

EARLY CIVIL TYPES

Types like this Curtiss were fostered by CAA predecessors.

An early civil development was this DeHavilland mail ship.

there were not more than a handful from coast to coast, and those were military.

A queer business to be going into—as a matter of fact, we called it the aviation "game." Even in those days that is what the majority of persons thought, and that is where—particularly in those days—they were wrong. Because flying was always a serious business venture, a venture in which only a high-publicized minority took unreasonable chances, and even those who did had a business objective in mind. Flying for fun is a comparatively new development of the last few years.

We aimed to take no foolish chances in the air mail experimental work. On the contrary, as to this day, we endeavored to work with the minimum of risk and tried to improve our equipment so our work could be done more safely at every opportunity. We got, in sum, down to business.

What were the problems upon which we worked at College Park, Md., field early in 1919? They were fundamentally the same problems upon which everybody connected with flying is puzzling over and working with to this day. Aviation is a hard taskmaster. There can be no compromise when dealing with human lives, and the unceasing crusade to make flying safe—and then safer—goes on and on.

We experimented with instruments—better compasses, rate of climb (or descent) indicators, turn and bank indicators, artificial horizons—to find devices which would enable us to fly more efficiently, and with less risk, in bad weather. In co-operation with the Navy and the Bureau of Standards we worked on aircraft radio compases and radio and induction airport localizers. The present radio compasses now required on scheduled passenger transports are highly refined developments of the crude devices we found to be fundamentally sound. The same is true of the gyro instruments in regular use today. What I believe to be the first all-weather runway constructed in the country was put in at College Park in order to keep the mail running through the first three months of 1919.

And I should like to emphasize that the work was not a flirtation with disaster—it was strictly business. To call the roll of the men who were in the same business at the same time, and still are, would be to write a long book. E. Hamilton "Ham" Lee, dean of transport pilots, was one of the mail pilots stationed at College Park. Charles S. "Casey" Jones was a frequent visitor there at the southern terminal of his flights carrying movies to New York and special editions of New York papers to Washington. Richard H. "Dick" Depew, Jr., now with Taylorcraft, was another. A. S. Koch, now CAA Director of Safety Regulations who, like scores of other present members of the CAA, got his flying lessons in World War I days, was doing such a profitable business as a barnstormer that he eventually took a year off and made a trip around the world. John P. Morris, now head of the Civilian Pilot Training Program, was making aviation history in Pittsburgh. Thomas B. Bourne, Director of Federal Airways, was with the National Guard at Logan Field, Baltimore, between stages of his market gardening activities in the neighboring rural area of Baltimore County.

We were all commercial-minded even then. I remember in 1919 how we sent out questionnaires to all air mail pilots to determine proper specifications for a genuine commercial airplane—one that would carry mail or other cargo in satisfactory quantities, at satisfactory unit operating costs. From their suggestions resulted proposals issued by the Post Office Department and, subsequently, contracts for three of the earliest types of ships designed primarily for commercial operations. One gave very satisfactory service, one was a failure, and the other was too far ahead of its time in size, power and carrying capacity.

In 1926, with the passage of the Air Commerce Act, came recognition of civil and commercial flying by the Government. Up to that time, the growth in charter business, instruction and exhibition flying throughout the country had been erratic. There was no control regulatory organization. With the passing of time, the aging of war surplus flying equipment and the increased volume of flying, it became more and more evident that one was needed.

Until that time every pilot was a free lance, and flew as he pleased, and where and when he pleased. Believe it or not, no Government licenses were required: you could climb in a cockpit without previous instruction whatsoever and take off!

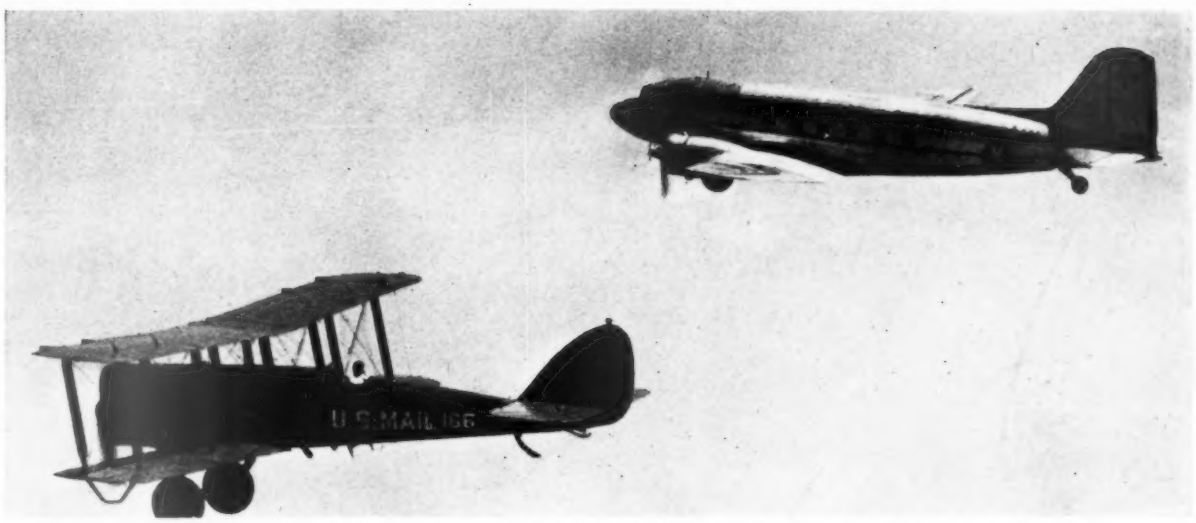
The Air Commerce Act changed that—and a lot of other things. It charged the Secretary of Commerce with the responsibility of promoting and regulating air commerce; it marked the first comprehensive Governmental effort to give aviation a substantial role in the development of our national economy.

Shortly after the approval of the Act by the President, the Aeronautics Branch of the Department of Commerce was organized. The name was changed to the "Bureau of Air Commerce" in 1934.

Under the Air Commerce Act pilots were licensed for the first time; in co-operation with the airline operators air navigation facilities were installed along the routes on which contract air mail service was established; flying rules and customs were established. Equally important, standards and requirements covering aircraft, airmen and the airlines themselves were set up.

To institute the "Aeronautics Branch," the Government hired a number of the most experienced commercial pilots available and asked them to work out rules and regulations which could be applied to pilots and flying in this country. It also employed others who combined engineering knowledge with flying experience to commence the survey and establishment of our matchless Federal Airways System. A surprising number of the top personnel concerned with airways and safety regulation in the CAA today began their Federal careers in the Branch during its first year. All of them had ideas, and out of their solid, practical knowledge these men developed the body which governs civil aviation today.

All sorts of sound and unsound airplanes were being built in those days and offered to the public with claims of excellence limited only by the imaginations of the designers and producers. The pioneer inspectors and aeronautical engineers of the Aeronautics Branch had to establish safety standards for the construction, testing and maintenance of aircraft engines and accessories, which have grown ever more exacting and comprehensive over the years and have proved one of the greatest contributions ever made to the safety of flight.



Striking comparison between the old and new is this picture of early DeHavilland mail plane flying beside modern airliner.

Anyone can still build any kind of aircraft he wishes and, under conditions prescribed by the CAA can flight test it; but according to Federal law he cannot fly it indiscriminately nor carry passengers in it, unless it is Federally examined and certificated as airworthy, and once it is so certificated it must be inspected periodically as to continued airworthiness to the satisfaction of the CAA.

Medical standards and flying competency standards for pilots of various grades were also established.

The duty of building the highways of aerial commerce—the Federal airways—was undertaken by the Airways Division, under the general supervision of the Bureau of Lighthouses in the Department of Commerce which had been engaged for years upon similar work on our ocean and inland water routes. By late summer of 1927, the Airways Division had surveyed and equipped with rotating beacons placed ten miles apart, and emergency landings fields placed 30 miles apart, a total of more than 1,400 miles of airways. Together with the 2,700 miles of airways which had been equipped and maintained by, and inherited from, the Post Office Department, these constituted the Federal Airways System, total of 4,121 miles.

The air mail service of the Post Office Department, in conjunction with a radio manufacturer had developed a relatively high power radiotelephone transmitter for air mail planes. In co-operation with the War Department and the Bureau of Standards, an experimental radio range station was established and operated at Monmouth, Ill., by the Post Office Department. This preliminary development work was of inestimable value to the Aeronautics Branch when it undertook the task of developing a system of communications and navigational aids for use by the aeronautical public—scheduled and non-scheduled commercial flyers, private pilots and pilots of the armed service and other Governmental establishments.

It was foreseen that aeronautical communication services must be speedy to make weather and flight information available in time to be useful. Because of this, the teletype method of communication was selected and installed for the collection and dissemination of meteorological information, reserving in general, the raidotelephone transmitting facilities for broadcast to, and communication with, aircraft in flight. Intermediate frequency directive radio range stations of the crossed loop type, were selected for the standard radio aid to navigation. Between 1928 and 1932 this type of equipment was installed along the air routes between New York and San Francisco, Boston and Key West, the southern route between New York and Los Angeles, Los Angeles and Seattle and other existing airways. At first associated with radio broadcasting stations, these radio ranges were later redesigned to use vertical tower radiators instead of loop antennas, which permitted combining with the broadcast stations to form the simultaneous radio range and communications stations which transmit radio range signals and weather broadcast or communications to aircraft at the same time and on the identical radio frequencies.

Thus was built the nucleus of the vast CAA radio and lighting aids to air navigation which today comprise a system covering more than 30,000 miles of airways within the continental United States including:

Simultaneous vertical indicator type radio ranges	171
Low and medium powered loop type radio ranges	105
Miscellaneous radio marker, voice and point-to-point communication stations	48
Ultra high frequency radio fan markers	122
Ultra high frequency radio ranges	8
Lighted intermediate landing fields	308
Airways beacon lights	2,276

A pilot may never see the ground from the time of his take-off at point of departure until he lets down through the clouds or fog over the airport at which he is to make his next landing yet, aided by navigation facilities of CAA's Federal Airways Service, he may know at all times exactly where he is.

At the end of the year in which the new Aeronautics Branch took over the responsibility of regulating air commerce, we had 8,252 miles of domestic airways and 152 miles of international airways. The domestic services existing at that time carried 3,555 pounds of air express during the year and 5,782 passengers. Today we have 30,913 miles in continental United States on which operating facilities and aids to navigation are installed. In 1941 our U.S.-owned airlines carried over 3,000,000 passengers, and more than 16,000,000 pounds of air express.

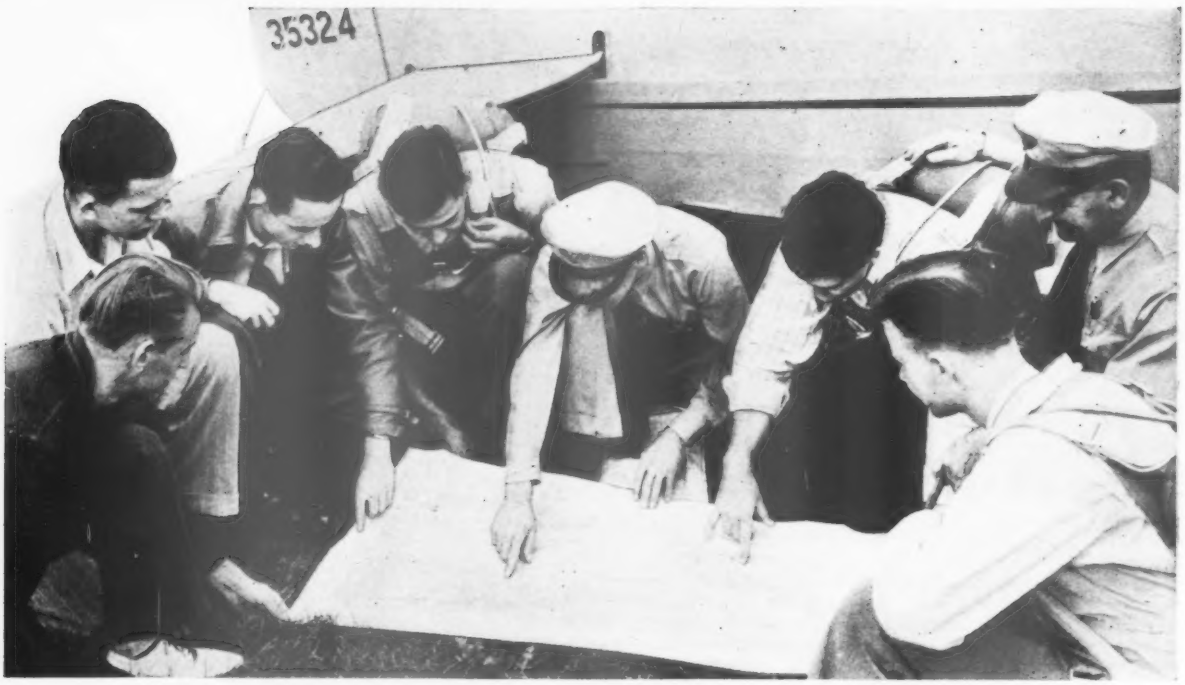
In 1926, few American operators were making any serious effort to attract passengers, but when shortly thereafter they did, they made a good job of it. The growth of the air passenger business has been one of the most spectacular developments in American aviation, and air transportation was one of the few industries to forge ahead during the bitter years of depression.

When air travel really took hold, the war type ships which were first used by the Post Office and the private operators rapidly gave way to faster and more comfortable types. Passenger traffic soared, prices for tickets dropped. In 1926, the average airline fare was 12 cents per mile. It has been consistently reduced and today it is approximately five cents per mile.

It was barely more than a decade before the Federal airways spread beyond the limits of the continental United States. During the past three years the CAA has been engaged in establishing emergency landing fields, radio ranges and weather communications and distribution services throughout the world.

In Alaska, because of pole line construction difficulties,

(*Continued on page* 66)



Students pore over aerial traffic pattern. Pilot "superman" myth was dissolved when CAA taught young America to fly.

AIRMEN

Creation of vast pilot reservoir proves value of CAA training program. Civilian flyers found fine material for service with fighting air forces.

by
JOHN P. MORRIS

Veteran of aviation's barnstorming era, Mr. Morris brings several decades of practical experience to present post as CPTP director. Born in Monaco, Pa., April 16, 1897, served as Army Air Corps instructor in France; was country's first municipal airport manager. Joined CAA as private flying specialist in 1939, was made training chief late in 1941.

THE idea that a pilot was a superman was a long time dying. As late as three years ago, thousands of communities did not number among their population even one of those "strange creatures" who could fly. If the residents did chance to see a pilot in the flesh, he was a barnstormer at a circus or county fair, whose stunts only confirmed their impression that flying was an occupation for daredevils, to be watched, but certainly not to be indulged in by common folk. Only one U.S. citizen in 7,300 could fly in 1938.

Then a remarkable transformation took place. In the plane-shy localities of yesteryear, conservative business men formed flying clubs and pitched into campaigns for new or improved airports. Banks advertised their readiness to make loans for the purchase of airplanes. Youngsters swarmed around airports like flies around honey and hedge-hopping became, potentially, anybody's sport.

I attribute this to the Pilot Training Program of the CAA. Of course, I'm prejudiced—I'm a pal of the program. But I was in aviation for 22 years before joining the CAA and I spent most of that time trying to bury the superman idea. I argued the benefits of flying till I was black in the face. But for all the efforts of all the barnstormers, there was not a great deal to show in the way of results.

Nothing, certainly, as effective as CAA pilot training. And today, prejudices or no, I still claim that the program has been the most beneficial thing that ever happened to civil flying in this country. You can stop me if I'm wrong. Otherwise—a little hangar flying with a moral. Move over and let an old-timer get his feet up to the stove.

I used to run a flying school. A handful of us, most of whom had contracted a chronic case of "flying fever" in the World War, were carrying the torch for non-scheduled aviation. In most cases, we got our pants burned for our pains, and for all our efforts, private flying inched along like a snail going up hill rather than like a P-40 in a power dive, the epitome of our dreams.

From the time of the Wrights' flight at Kitty Hawk in December, 1903, until July 1, 1939, our pilot roster grew to just beyond the 25,000 mark—in a nation of 130,000,000 people who had had airplanes to play with for more than 35 years. We had given the airplane its birthplace—and then passed it by for more earthly mechanical wonders like the automatic ice box and the automobile!

Then came Hitler—and the need for planes, more planes—coupled with the need for men to fly them. CAA went to work. As a result, we have multiplied our list of private pilots more than four times since 1939. On January 1, 1939, the total was a mere 22,983. On October 1, 1941, CAA certifi-

cates (not including 90,000 student permits) were held by 91,422 pilots, and the year-end round figure total is more than 100,000—a magnificent reservoir of flying warriors.

Of those 100,000, some 65,000 learned to fly in CAA elementary courses. Thousands more were upgraded to commercial pilots and instructors through CAA advanced courses.

The story is an impressive one statistically, but for hangar-flying purposes, let's glance at the human angles. There was, for instance, the flight school operator in Ada, Okla., who says that a few years ago the town's aviation consisted of "one airplane and me." After CAA got going, Ada had two hangars full of airplanes, 11 of which were privately owned; 90 CAA-trained fliers, and a $350,000 airport under construction.

Then there was the case of a midwestern town in the same population bracket, which now has 86 certificated fliers, half of them CAA trained and the other half coming from the Main Street offices of doctors, lawyers, bankers, merchants and farmers. The town formerly had one flying club with 12 members. Now there are four clubs with 58 members and 13 airplanes. Here, too, a municipal airport is under construction.

I could go on like this for hours, because more than 700 training centers have been bitten by the CAA pilot training bug.

The point is that the CAA program went beyond the boys it has trained in helping aviation. CAA trainees must be between 19 and 26, able to pass a physical examination which corresponds to those for the Army and Navy and, in a great number of centers, must have two years of college.

But others of all ages and background flocked into the flying schools holding CAA contracts to buy time on their own and learn to fly.

"If Johnny Jones next door could learn to solo a plane in eight hours," they reasoned, "so can I, even if I am a couple of years too old for a CAA scholarship." With tens of thousands of CAA-trained pilots like "Johnny Jones" living next door to everywhere, the job of "air conditioning" America right down to the very grass roots was accelerated tremendously.

These experiences under the CAA program—America's first attempt at mass production of pilots—has driven home some points that are fundamental in the air conditioning process. It has proven that learning to fly can be safe—as safe, I venture to say, as learning to drive an automobile, provided a carefully controlled system of instruction is followed. Such a system is required at CAA contract schools, and up to September 1 last, more than 75,000 courses had been completed in the CAA program, with only 27 student fatalities. More than 6,400,000 miles were flown per fatality—over twice as much mileage as the most experienced airline pilot has packed into a lifetime, and four times as many flying hours.

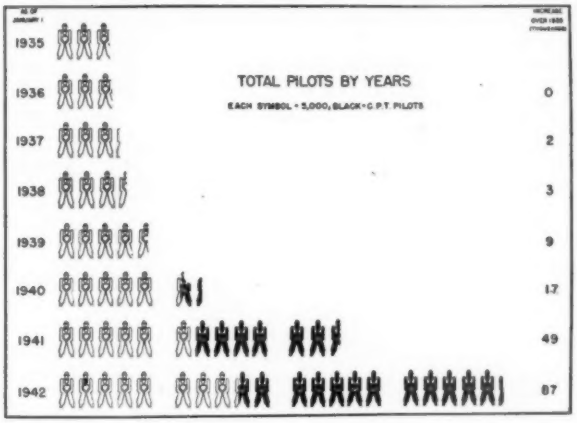
The CAA program has also created the healthy nucleus of a mass market for light planes—another prerequisite to making aviation "popular" in the true sense of the word.

The demand by the newly trained thousands of pilots for planes of their own cannot be satisfied, of course, until the war is over, at which time it will prove a valuable backlog for the industry. But the effect of the CAA training program, which has a wartime importance recognized by priority officials, already has been felt by the aircraft manufacturers. During the first six months of 1941, a total of 3,775 planes for civilian use were produced, and increase of 65 per cent over the corresponding period in 1940. Of the total, 92 per cent were of the types used in CAA elementary and secondary flight training.

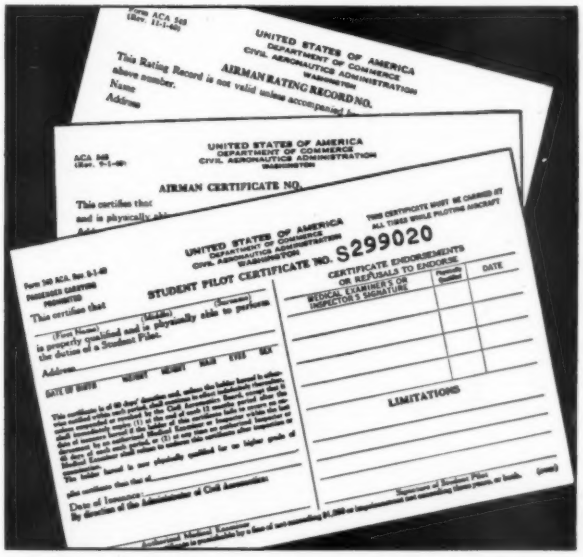
CAA pilot training activities have been responsible for the establishment or reopening of 173 airports, and if there is one thing on which private flyers agree it is that they need more fields where they can enjoy flying without fear of tangling up with an airliner or Army tactical plane. A typical case of airport construction stimulated by the pilot training program is Western Union College at Le Mars, Ia. This little institution, with an enrollment of 400, has constructed a new airport and hangar costing $20,000.

The colleges of the United States have been thoroughly sold on aviation as a result of the CAA training program. In two years, over 500 of them have begun to give regular academic credit for successful completion of flight courses. They

Lightplane market should benefit greatly when new pilots trained in CAA, as above, may follow peacetime pursuits.



Influence of CAA in increase of private pilot total can be seen in contrast of black (CAA) symbols and others.



All flyers, student or advanced, must be certificated by CAA. More than 200,000 held "tickets" on December 1, 1941.

are recognizing that a knowledge of aviation is as important a part of a young man's equipment for modern life as economics, English, or other subjects which have been standard in the curriculum for many years. An established place for aviation in the educational system, from the grade schools through the colleges, so that the entire rising generation will be air-conditioned, was one of the goals of Robert H. Hinckley when the Pilot Training Program was founded. For this reason, he rejected pressure to set up seven huge Federally-operated centers, and instead insisted on decentralizing the job by contracts with hundreds of colleges and flight schools.

This democratic decentralization made possible the quick response of the CAA in the summer of 1940, when a tremendous expansion in its Pilot Training Program was called for because of critical developments in the international situation.

The growing air forces of the armed services have drawn heavily from this reservoir of pilot material. One out of three cadets currently entering Army and Navy aviation have had CAA training. For over a year, applicants for CAA training have pledged that they will offer their services to the armed forces as needed, and today CAA boys are volunteering in increasing numbers.

Previous CAA training of cadets effects enormous savings in time, money and equipment for the armed services. The boy who has successfully completed a CAA course will in 88 cases out of 100 also make good in Army primary flight training, while less than 57 out of 100 cadets without CAA training can make the grade.

On this basis, the Army's goal of 30,000 cadet graduates a year could be achieved with 19,000 fewer washouts if all students came from the CAA "incubator." Since every Army washout is estimated to cost $1,831, against $126 for CAA "flunkees," a saving of tens of millions of dollars is involved, not to mention the release of valuable teaching personnel for other duties.

The CAA program has provided almost 2,000 instructors for defense units here and in Canada, and is currently training 3,200 graduates of its elementary courses up to instructor level, to avert a threatened bottleneck in this field of defense.

The CAA does not claim to turn out military pilots, but any boy who passes through the "sieve" of its tests is pretty sure to have the stuff for development into a fighting flyer. Two-thirds of the American Eagle Squadron with the RAF received their initial training under CAA auspices.

The contribution of CAA pilot training to defense is its justification for existence in these critical times, but with peace, its lasting value will be seen in skies dotted with private planes.

In their cockpits will be men and women for whom flying has been made commonplace, but nonetheless exhilarating, by the CAA Pilot Training Program.

END

Regional Expansion

by
HOWARD F. ROUGH

Regional manager at large for the CAA, Mr. Rough has had much to do with organization of its field personnel and program through his activities as assistant director of the Bureau of Air Commerce, predecessor of CAA. Born January 1, 1891, at St. Joseph, Mo., Mr. Rough joined the Army Air Corps in 1917, was assigned as instructor at Issoudon, France.

NO matter where you live in the United States, there is a Civil Aeronautics Administration representative nearby, thanks to an expansion of the field force from less than 50 in 1926 to a present personnel of 5,449.

The growth of aviation dictated a policy of decentralization of the personnel and offices of the CAA. Without this decentralization, service to the flying man and the aviation industry on the scale required today would be impossible.

The country has been divided into seven regions, with an eighth region recently established in Alaska. These regional boundaries were established with the object of dividing as equally as possible the existing and planned airway mileage and communications facilities of the United States, the number of aircraft and airmen and the concentrations of aircraft manufacturing operations. Also, due consideration was given to natural boundaries, population and normal movements of commerce. These divisions have proved to be so highly efficient that the Weather Bureau, which is now so closely related to aeronautics that it considers weather reporting for aeronautical purposes its major responsibility, has recently adopted the same regional set-up, with headquarters generally in the same cities with the CAA.

At each of these eight CAA regional headquarters, a manager is in charge. These are men who have been selected from the ranks, and who have had wide experience in aviation. Under each one is a specialist in charge of every phase of the CAA's work. This means that direct official action on the great majority of CAA problems is taken in the field.

By far the largest portion of the field force of the CAA is concerned with the operation and maintenance of the airways facilities, including traffic control. This personnel is widely dispersed with many stations at remote points along the airways, but all in constant touch by radio and teletype with aircraft operations.

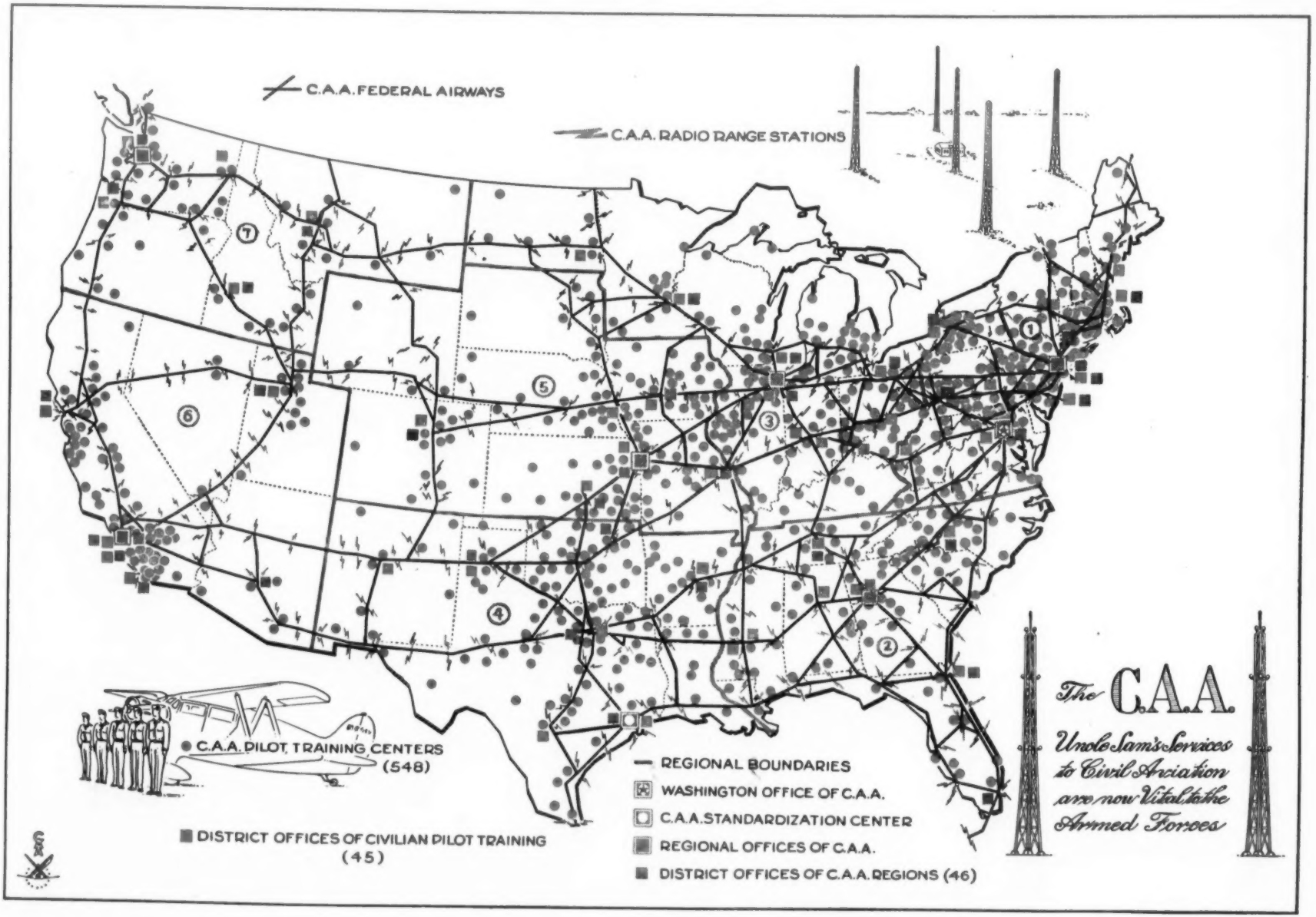
In order to bring the service of the CAA still closer to the public, 48 District Offices within the regions have been established, at which are stationed General Inspection and Civilian Pilot Training personnel and, in some of the offices, Air Carrier Branch personnel as well. These men move about their areas on schedules which are posted at all airports in the region concerned, and the average citizen with CAA business to transact finds them easy to locate and see. In addition, General Inspection personnel are stationed at 26 other points in the United States. These are called General Inspection Field offices as distinguished from District offices at which other than General Inspection personnel are stationed.

The setting up of these District and Field offices has obviated a lot of travel, since prior to their establishment it was necessary for inspectors to travel far from home base to cover their territories.

Still another expansion of CAA service has been accomplished recently with the appointment of nearly 700 experienced pilots and operators in the industry to honorary positions where they assist the aircraft and aeronautical inspectors of the General Inspection Service. All these are carefully selected and their services are purely voluntary. They are designated as authorized flight examiners or aircraft inspection representatives, depending on the work their base has been designated to perform. In the absence of a CAA aeronautical or aircraft inspector, they are qualified to make inspections, give examinations and actually do the work of the regular inspector.

Following are the regional managers and headquarters for the regions: Region One, John E. Sommers, New York; Region Two, George W. Vest, Atlanta; Region Three, Harold R. Neely, Chicago; Region Four, L. C. Elliott, Fort Worth; Region Five, Leonard W. Jurden, Kansas City; Region Six, J. S. Marriott, Santa Monica; Region Seven, R. D. Bedinger, Seattle; Region Eight, Marshall C. Hoppin, Anchorage, Alaska.

END


C.A.A. FEDERAL AIRWAYS
C.A.A. RADIO RANGE STATIONS
C.A.A. PILOT TRAINING CENTERS (548)
DISTRICT OFFICES OF CIVILIAN PILOT TRAINING (45)
REGIONAL BOUNDARIES
WASHINGTON OFFICE OF C.A.A.
C.A.A. STANDARDIZATION CENTER
REGIONAL OFFICES OF C.A.A.
DISTRICT OFFICES OF C.A.A. REGIONS (46)
The C.A.A.
Uncle Sam's Services to Civil Aviation are now Vital to the Armed Forces

AIRWAYS

Built and maintained by CAA, the airways of the United States, geared for war, surpass in excellence airways systems of all other countries.

by
THOMAS B. BOURNE

Mr. Bourne has been closely identified with airways development since 1927 when he held post of airways extension superintendent in Bureau of Lighthouses; now is director of Federal airways system in CAA. Born January 9, 1896, in Baltimore County, Md., he first flew in 1918, holds pilot license No. 209; was Army Air Corps flyer during World War I.

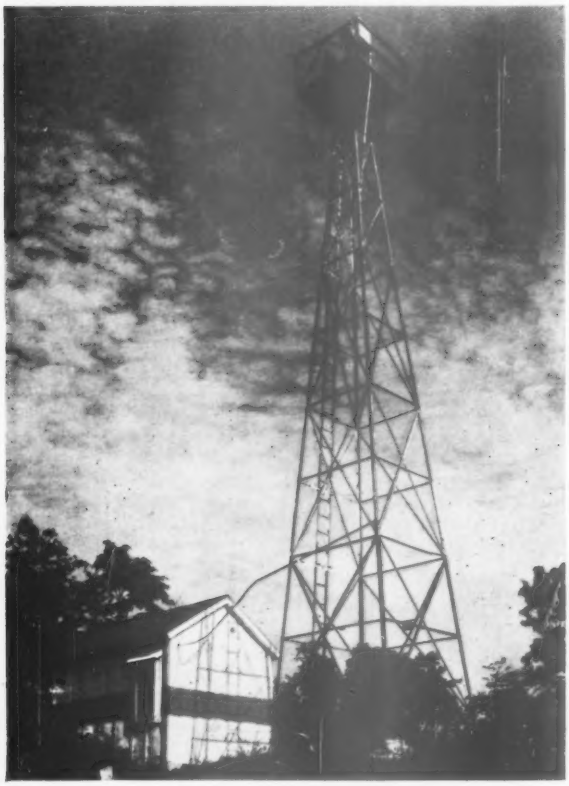
THE development of two important radio facilities, the ultra high frequency range and the radio landing system, which the Civil Aeronautics Administration proposes to install on a number of existing Federal airways, will permit for the first time in aviation history the planning and construction of a modern system of radio aids on a comprehensive national scale. When this three-year program has been completed the primary air routes of the United States will be equipped with these new facilities.

When the need for air navigation facilities first became evident the extent of flying activities and the degree of anticipated growth did not contemplate, nor permit the development of a master plan, inasmuch as such a plan would have to be predicated upon advance knowledge of the ultimate to be reached in air traffic. Further, radio aids to air navigation were at that time in an experimental infant stage, the modern airliner had not yet been developed, and the entire industry was just beginning to react to the impetus provided by the development of the airplane as a result of World War I. Although it was a foregone conclusion that scheduled and non-scheduled operations would increase, the rate or manner of increase was, of course, unpredictable. As a result the airways system grew in piecemeal fashion, keeping pace with the trend of aeronautic activity. Each year as new air mail and passenger routes were inaugurated to serve new areas and additional communities, additional airways were established and implemented with the facilities that were available at the time, thereby forming an extension to the existing system. Each new airway was planned as an individual unit and tied into the existing facilities in the best manner possible.

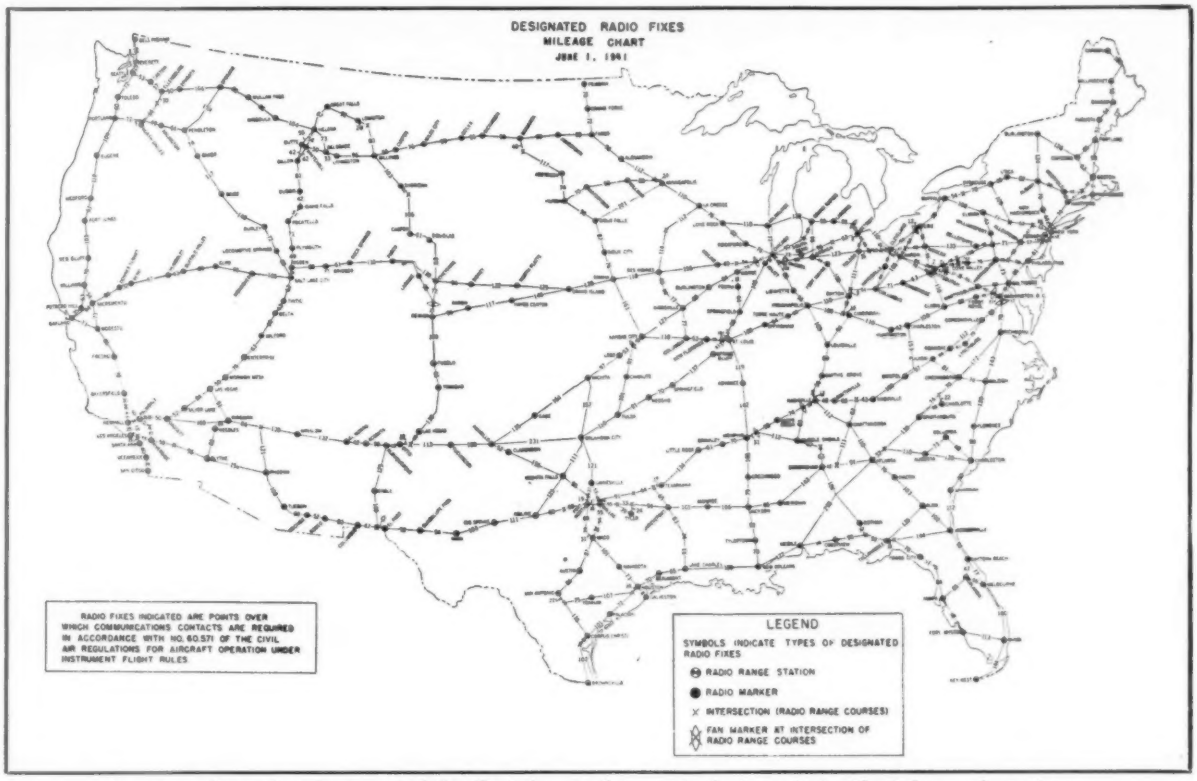
Thus, each component airway was developed and improved as an entity in itself and from time to time as service was extended and facilities were improved additions, deletions and relocations were effected as required by the steady increase in traffic and subsequent need for wider margins of safety.

In the early days of development of air transportation the

Many beacons in isolated sections require own powerplant, as does BE-8, 51-foot tower on Baltimore-Buffalo airways.

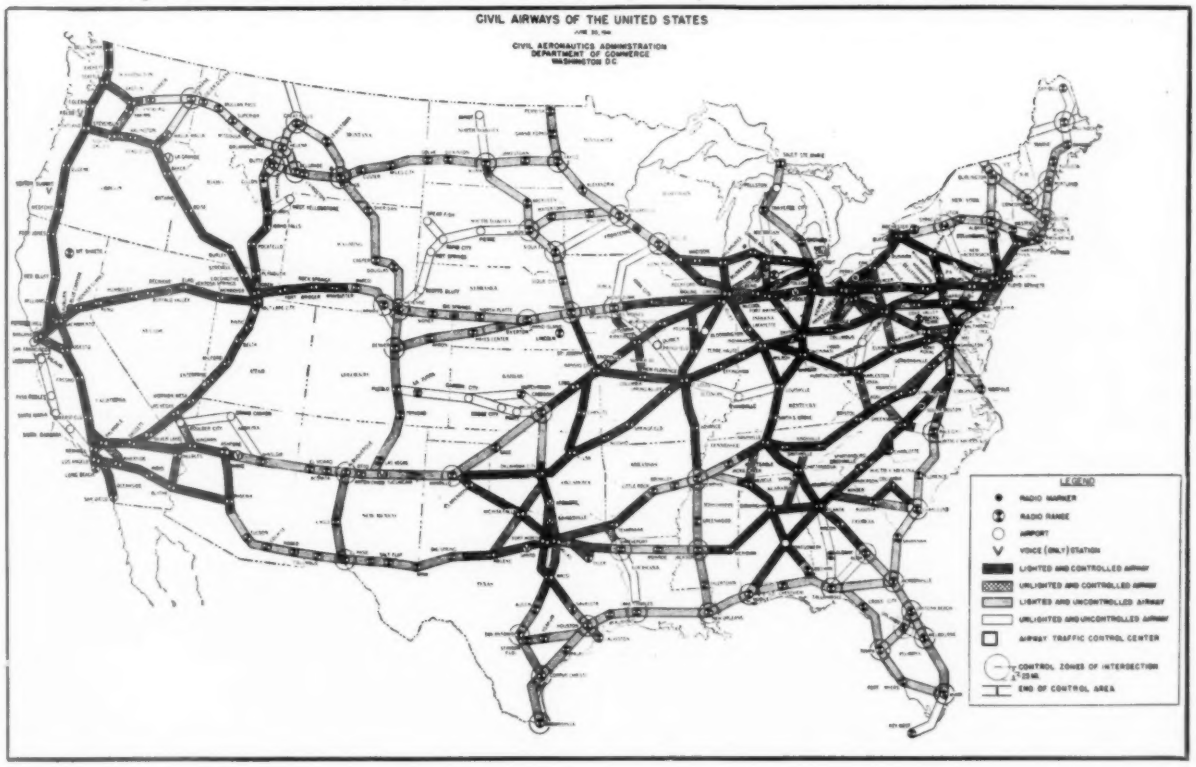


Termed a "self-powered site," this beacon has automatic controls, is one of many placed across American desert.


DESIGNATED RADIO FIXES
MILEAGE CHART
JUNE 1, 1941
RADIO FIXES INDICATED ARE POINTS OVER WHICH COMMUNICATIONS CONTACTS ARE REQUIRED IN ACCORDANCE WITH NO. 60.571 OF THE CIVIL AIR REGULATIONS FOR AIRCRAFT OPERATION UNDER INSTRUMENT FLIGHT RULES
LEGEND
SYMBOLS INDICATE TYPES OF DESIGNATED RADIO FIXES
RADIO RANGE STATION
RADIO MARKER
INTERSECTION (RADIO RANGE COURSES)
FAN MARKER AT INTERSECTION OF RADIO RANGE COURSES

A vast radio network operated by CAA keeps pilots constantly in contact with vital ground stations. Only in this way can so-called "blind flying" be conducted on safety level maintained by civil aviation under CAA rule.

Although U. S. civil airways as shown below are known to be greatest in world today, entire airways system will be redesigned on a national scale with emphasis on direct routes, elimination of outmoded sections and increased use of radio.



Located on bleak mountain top is this "windmill watchman," so named because it must depend upon wind-driven generator for its power. Once a site has been selected, CAA overcomes all obstacles.

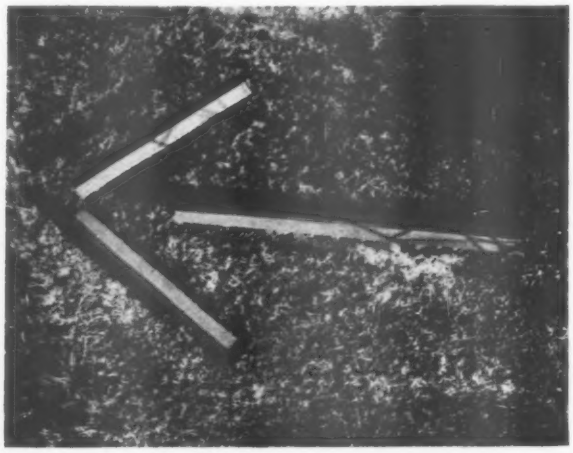
trend was toward avoiding the intermediate points and providing service to only those larger industrial areas where a large volume of business was assured. As time went on it became increasingly evident that the smaller cities and communities had a definite need for air mail and passenger service. Intermediate stops became more numerous until it became apparent that local and express service would be necessary if speed, the principal sales point, was to be maintained. Thus, more air navigation facilities were required to serve more points and existing air navigation facilities had to be modernized, enlarged and otherwise improved to accommodate large modern aircraft and the ever increasing volume of traffic. Extensive research and experimental work was undertaken for the development of new air navigation aids necessary to the operation of increased schedules to a greater number of points and now brings to the fore the problem of traffic control and separation of aircraft along the airways and at the junctions of airways. The current and anticipated great increase in the volume of air traffic, the construction of new airports and the rapid growth of military aviation training activities further aggravates this problem. Its solution is fairly simple and involves the establishment of air navigation facilities in a manner that will permit the unhampered use of these facilities by either express or local traffic as well as an arrangement of terminal facilities to provide standard flight procedures at all airports.

Until very recently the frequency band from 200 to 400 kilocycles was the only band available for radio range stations and very little was known of the ultra high frequencies, particularly in connection with their use for such directive facilities. Two undesirable features of the intermediate frequency band provided the basis on which experimental work was conducted. Intermediate frequencies are subject to considerable interference caused by static, and the frequency and geographical separation of the stations did not permit the establishment of additional facilities in this frequency band without causing interference with some other station on a

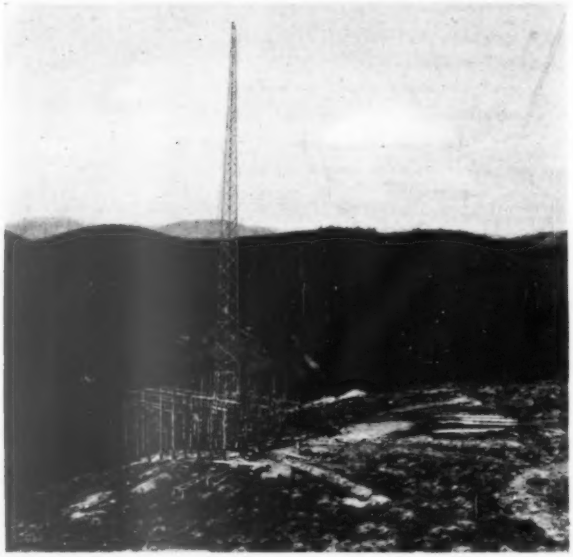
(*Continued on page* 65)

Every device of modern science, such as flight progress board below, is used by CAA to assure air travel safety.

Pointing the way is this all-weather arrow, an additional aid to pilots seeking directions at CAA rotating beacons.

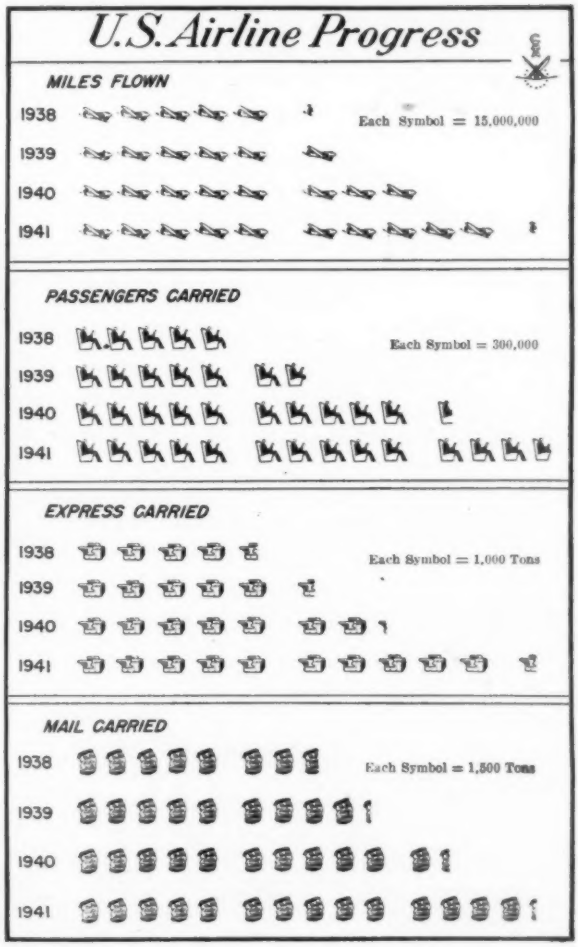


Typical CAA airways station above is located on the edge of an intermediate landing field. It is especially equipped to aid pilots making emergency landings, as well as guiding those aloft.



Lookout Mountain, Chattanooga, Tenn., is now topped by this airways range tower, a welcome aid in rough terrain.

Radio range signals forming directive courses are sent to pilots by communication stations, also weather news.



AIRPORTS

The CAA development program has been planned to fulfill war emergency demands, yet provide for peacetime growth.

Operated by CAA, Washington National has been called the world's most modern airport.

by Col.
LUCIUS D. CLAY

Engineering problems arising in the CAA find Colonel Clay well equipped to meet them. A graduate of U. S. Military Academy and U. S. Military Engineers' School, he has been identified with huge projects in the U. S., Canal Zone and the Philippines. Born in Marietta, Ga., April 23, 1897, Colonel Clay now is the assistant to the CAA Administrator.

THE defense airport program being undertaken by the Federal Government has not been fully understood by the public, nor even by aviation devotees, primarily because it has involved four separate Government agencies—the Army, the Navy, the Work Projects Administration, and the Civil Aeronautics Administration. Many flyers interested in airport development have not understood the methods under which the sites included in the program were selected, as frequently sites have been included which seem relatively unimportant from the immediate viewpoint of civil aviation. Nevertheless, as a result of this airport program, the private and commercial flyers of this country will find with the end of the emergency many more and better airports than were ever available before, and the United States will be well on its way to a realization of the 4,000 airports program predicted as needed in the interests of commercial aviation in a Civil Aeronautics Administration survey undertaken in 1938.

This survey which was made possible through the co-operation of state aviation officials and the WPA has formed the basis for the war airport program now under way. It developed information and data with respect to some 4,000 airports throughout the United States, of which approximately 2,000 could be classified only as pastures utilized for the landing and take-off of small aircraft. A handful of the remaining 2,000 could be considered worthy of the designation "airport," with only five meeting the Class IV specifications of the CAA and only 31 meeting the standards established for Class III airports. In other words, only 36 airports were then available for all-weather use by all types of aviation.

Some time prior to the emergency the responsible officials of the CAA had recognized that the development of airports in the United States and its possessions was not keeping abreast of our expansion in the air, and that already the available airports were inadequate both in size and in number to meet existing commercial demands. It soon became apparent that the rapid expansion of our military aviation with military air-

Washington National Airport, a CAA project, already surpasses famed LaGuardia Field in capacity and facilities.

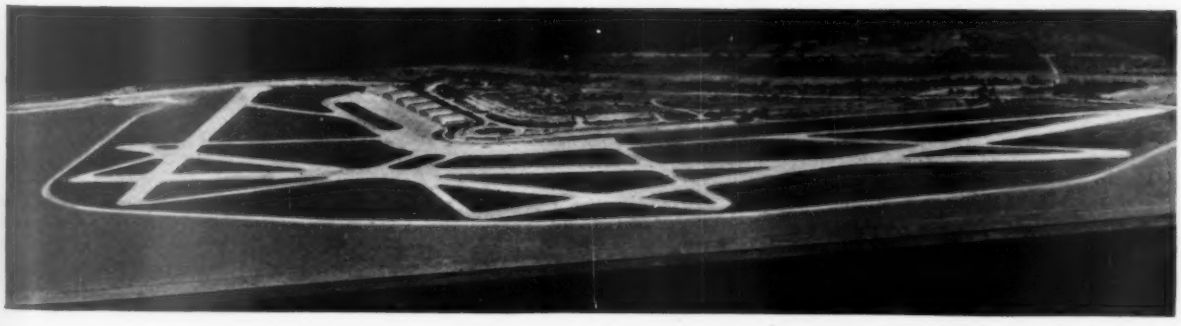
Air travelers from all over the world daily pass through this modernistic terminal building at the Washington National Airport. Today the airport terminal is as important as the railroad station.

craft beginning to roll off new assembly lines would require many more airports to meet wartime needs. These needs could not be satisfied merely by the provision of airports to base the new aircraft, as in a country of the huge size of the United States it may become necessary to concentrate large air forces in various sections. Hence the strategic areas of the United States had to be provided with sufficient airports to permit some concentration of air forces. Moreover, air routes had to be established to permit the rapid movement of aircraft between strategic areas. In addition to strategical and tactical requirements many fields were needed for training purposes.

The Army and Navy realized the huge expenditures which would be required to provide exclusive military fields for their purposes and hence were glad to have the CAA sponsor the development of commercial fields which could also be used by the Army and Navy. In this way the fields which were essential in plans for defense could also be utilized by civil aviation both during and after the emergency, and the investment of the Federal Government for defense would be enhanced by its future value to commercial aviation. Frequently the fields being developed in this program are occupied by military units under a joint-occupancy lease which protects the rights of civil aviation. In a few instances, traffic congestion has required the removal of private flying and training activities from jointly-occupied fields to other fields to the immediate inconvenience of these types of flying. However, in most of these instances auxiliary fields have been made available for the purpose. Moreover, this temporary inconvenience will be off-set by the additional facilities which the program will afford to all types of aviation when the present war ends. As CAA Administrator Donald H. Connolly has often pointed out, "The defense airport program is really killing two very important birds with one stone; that is, it is bolstering our defense, and at the same time giving airport development a flying start for the post-emergency activities of civil aviation."

The first appropriation for the airport program which became available in October, 1940, authorized the construction of 250 airports and appropriated $40,000,000 for the purpose. These funds permitted 200 of the authorized projects to be placed underway. To avoid any loss of time in placing projects underway, the services of existing construction agencies were utilized to include the Bureau of Federal Airways of the CAA, the Corps of Engineers, U.S. Army; the Bureau of Yards and Docks, U.S. Navy, and the WPA. It was evident that the appropriation would not suffice for the completion of 250 projects, and subsequently Congress appropriated additional funds in the amount of $33,000,000 for this phase of the program. It also authorized 149 additional airports with an

This model of the Washington National airport shows grouping of buildings and web-like pattern of runways.



Interior view of the Washington National Airport terminal, showing glass frontage overlooking field.

appropriation of $62,000,000, to which $5,000,000 was subsequently added for airports in our overseas possessions. Thus our immediate authorization contemplates the development of 399 airports with appropriations aggregating $140,000,000.

The defense objectives for the additional 149 airports were even more specific than the objectives established for the earlier program. These objectives had in view the provision of at least three Class III or Class IV airports within a radius of 100 miles of tactical stations to permit a dispersion of activities and varied flight training; and similarly a minimum of at least three Class III or Class IV airports within a radius of from 250 to 400 miles from the advanced Army training schools for flight training purposes. The additional funds became available in July, 1941. At the present time more than 300 of these airports are actively under construction and the remaining sites will be under construction at an early date. A general map showing the location of these airports and their relation to the several strategic areas cannot be published. However, the completion of the program will find our coastal and southern areas well equipped with modern airports for the first time and hence ready to meet the demands of our expanding aviation.

More than $100,000,000 will be spent this year for airport improvement. Here is drainage ditch for new Muscle Shoals port.

It is true that the established defense objectives have frequently made it necessary to include sites in the program which offer less commercial value than many sites which have not been considered. However, every effort is made in meeting a specific defense requirement to select the site meeting this requirement which has the greatest commercial promise. Ordinarily the requirements established by the Army and Navy specify in fairly close terms the area in which the airport must be located. Within this area commercial considerations are given full weight in determining the site to be improved. Moreover, there is no site included in the program which the CAA does not believe to have a promising future for use by civil aviation.

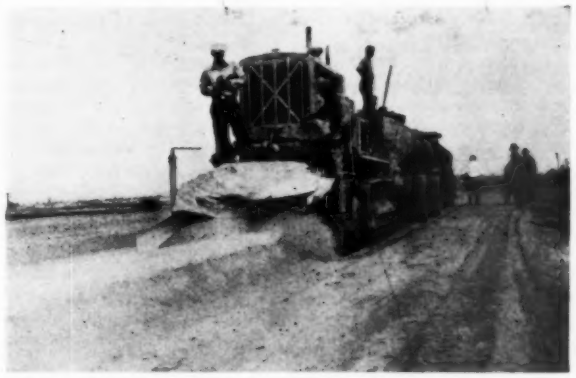
The projects included in the defense airport program must be approved by a board composed of the Secretaries of War, Navy and Commerce as necessary to national defense. This board has also approved the policy under which the program has been developed. Under this policy, Federal funds are expended on the improvement of landing facilities only, to include clearing, grubbing, drainage, preparation of runways, surfacing and the provision of basic and contact lighting. The proposed site must be made available for development without cost to the Federal Government by a political subdivision of government which retains title to the site and also agrees to maintain and operate the improved airport in the general public interest and to protect its approaches within the full power of existing laws. Under this sound policy, the ownership and control of these civil airports is kept in the municipalities and counties where it rightfully belongs. We have experienced some difficulty in effecting agreements with po-

Gravelly Point, site of new Washington airport, before workmen filled it in and sodded large landing area.

litical subdivisions because of existing leases which to some extent violate the provisions of the Civil Aeronautics Acts of 1938 prohibiting the expenditure of Federal funds on any airports where exclusive rights have been granted. However, both lessees and lessors have approached this problem with the best interests of aviation in mind and in all instances it has been possible to secure revision of such leases to accord with the Act. In general, the municipalities throughout the United States offered a place in the program have been quick to respond, and the co-operation which the CAA has received from local officials speaks well for the grip which aviation now has on the public interest.

The CAA has made every effort to obtain proper engineering design and construction at all of the projects included in the program. The term "airport engineer" is relatively new in the engineering field, and many fields constructed in the past few years give proof of this statement. Fortunately there has been an increasing tendency for civil engineers to specialize in the principles of airport design and as a result we are getting better fields now than in the past. Lighting has been greatly improved and standardized; runways have been increased both in quality and in dimensions; more attention is being paid to drainage and the preparation of the sub-grade; and runways are being designed to meet the unit loads developed by the heavy military bomber and civil transport. In our own program soil studies are made at each site to determine a suitable type of sub-grade and surface treatment. Cement and asphalt stabilization and concrete are being utilized successfully as required by soil conditions. While this program is designed to meet a wartime need, the urgency of the work is not resulting in hasty, poorly designed construction, but in an enduring improvement which will be of value to aviation for many years to come.

During the period that this program has been underway the WPA has also been engaged in an airport construction program. As a result of the construction work of both agencies, the United States will have with the completion of this program at least 87 Class IV airports and 370 Class III airports, exclusive of strictly military fields. Sites are being developed with runways of lesser dimensions than required in standard



Workers, using tractor, level off Los Angeles municipal airport.

Class III specifications only at a very few locations where point defense has required a landing field which was not physically susceptible of full development. However, we have not as yet met war requirements, and we have under consideration at this time an extension to the program which will add approximately 100 airports to those now underway. When the war ends we will be indeed a long way ahead of the conditions found in our 1938 survey when there were only 36 airports meeting Class III standards throughout the United States.

Perhaps we should not consider the war airport program as a long-range program to meet the future requirements of civil aviation, as necessarily the airports have had to be concentrated in specific areas to meet defense requirements. Nevertheless, these airports will fit into any long-range airport program, and the urgent need created by the war will result in a permanent contribution to civil aviation when peace returns.

END

APPLIED MEN

CAA psychological test previews students' flying ability, detects large percentage of those destined to fail in actual pilot course.

by Dr.
DEAN R. BRIMHALL

The application of psychological research to the solution of pilot training problems is the special forte of Dr. Brimhall, CAA director of research. Holder of A.B., A.M., and Ph.D. degrees, he was professor of psychology at Brigham Young University for six years. In 1938 Dr. Brimhall was appointed assistant to the chairman of the Civil Aeronautics Board.

CAA research might well have as its slogan, "Put the laboratory into the cockpit." This is particularly true in the case of the research program connected with CAA pilot training.

When this first real attempt at mass production of pilots was begun, the question immediately arose, "What standards shall we use in selecting thousands of student pilots, so that we will get the best possible material?" It was realized that it would take several years to find even rough working guides for selection, but it was also plain that here was a rare opportunity to study the question on the basis of actual performance.

There had been no large scale training of pilots since the first World War, when aviation psychology was very young, and only the most elementary sort of studies could be made. Now thousands of young people from every part of the United States, with all sorts of backgrounds and an almost infinite range of physiological and psychological make-ups, were to be put through a uniform course of flight training. Most of the training centers were at colleges and universities with skilled research personnel and equipment right on the spot.

Conditions appeared to be ideal for development of tests that would predict pilot aptitude, and also for improvement of the training technique. Since advances along these lines would be real contributions to both private flying and national defense, the CAA was authorized to set aside part of its pilot training appropriation for research.

The contributions of the CAA pilot training research program to national defense are already so significant that only a few of them can be revealed, for fear of giving "aid and comfort to the enemy." Obviously, the nation which can train pilots with the least waste motion has a definite advantage in the race for aerial supremacy.

Thanks to the research program, it is no longer necessary to ask an instructor "How well can Jack Green fly?" Subjective opinions are eliminated by putting the student through a standard set of maneuvers, and getting on film an exact record of the way he handles the plane, by means of a hidden motion picture camera and duplicate instrument panel. In addition to the usual instruments, this panel includes a special device which indicates movements of the stick and rudders. In synchronization, eye movements of the student can also be filmed. Study of these films has been useful in improving pilots' landing techniques, and in correcting bad habits which instructors had never been quite able to analyze.

Another development of the program, simple yet amazingly effective, has been the recording of conversations between students and instructors during flight lessons. Analysis of the methods used by different instructors, correlated with performance of their students, should reveal the most effective teaching approach and throw particular light on the choice of words which register best with students concentrating on "all eight cylinders," It is amusing to watch instructors hear these records played back for the first time; they will swear they never said any such thing, but the wax does not lie, and the result usually is a much more carefully thought out plan of instruction.

It is also permissible to mention that the program has produced instruments which measure perspiration and muscle tension of the student pilot while in flight, without hampering his movements.

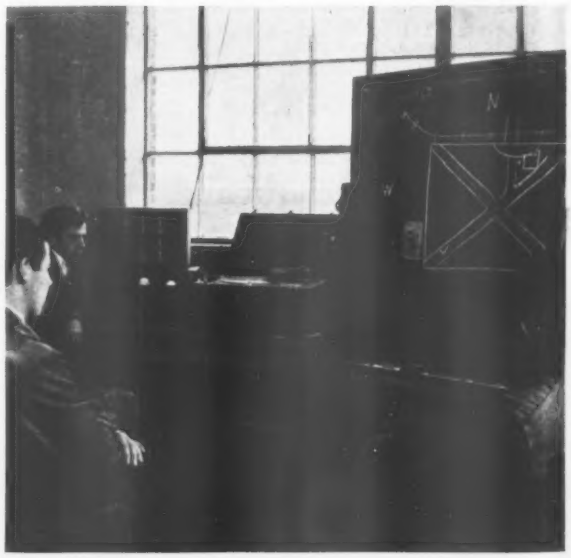
The CAA is fortunate in having for its pilot training research the guidance of the National Research Council, an agency of the National Academy of Sciences founded by President Lincoln, and the assistance of some 30 colleges and universities, as well as the full co-operation of the Army and Navy air services.

One CAA research project pointed the way, recently, to huge savings in time and money in the training of pilots for the Navy. CAA experts worked with hundreds of students and their instructors at Pensacola. Eventually a set of tests were devised which "previewed" a student's flying ability. It was found that by weeding out the lowest 10 per cent of prospects who took the tests, 50 per cent of those destined to fail the Naval flight course were automatically eliminated.

It is results like this which led Comm. J. R. Poppen of the United States Navy to say of the CAA research program that "its achievements thus far exceed those of the past 25 years in this field."

END

Purdue University students listen to recording of flight lesson transmitted from plane, follow route on blackboard.



RESEARCH

MACHINES

Instrument landing system is triumph of CAA technical development. Many more mechanical wonders to further safety are being readied.

by
JOHN EASTON

Chief of the CAA Technical Development Division, Mr. Easton supervises varied projects aimed at air safety betterment. Born in Scotland, he studied engineering at University of Edinburgh, came to U. S. in 1923, entered Federal service in 1930. Mr. Easton has worked with Buhl, Stinson and other commercial aeronautic companies.

RESEARCH is often thought of as an activity carried on in secluded laboratories by academic people whose interests are far removed from those of the average man. In the case of aviation, however, this is anything but the truth. Every day, aviation researchers are making flying more efficient, thereby doing their share toward speeding the war effort toward victory.

This job of shaping futures in aviation is big enough to engage the attention of every organization connected with the industry and to keep them all busy, for in a relatively new field like aviation some of the greatest developments are yet to come. The CAA makes its contribution to aviation progress by tackling the applied research tasks which do not come within the scope of other agencies, private or Governmental.

The applied research programs of the CAA have developed out of attempts by CAA personnel to perform more effectively the duties assigned them by the people of the United States, through Acts of Congress. That is why the Technical Development Division was organized in 1937. Before that date, the various operating units of what was then called the Bureau of Air Commerce had to handle their own developmental problems with the result that these were largely neglected, through press of other business.

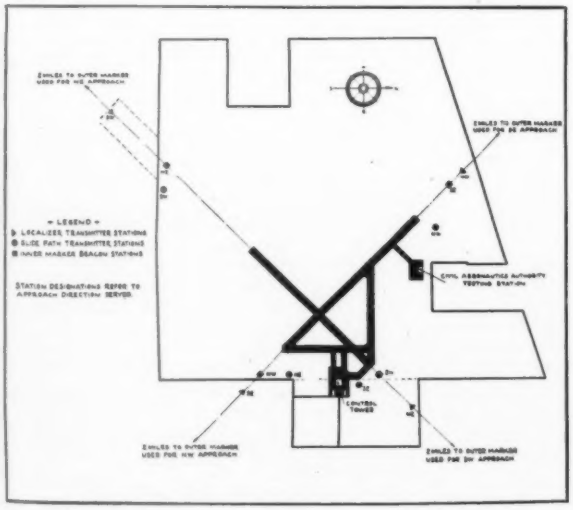
The unified division has tackled a wide range of problems in its four busy years. Among its outstanding achievements are those in the field of ultra-high frequency radio. UHF equipment, it is expected, will contribute greatly to safety, since it will take radio air navigation aids out of the very congested low and medium high frequency bands and is not subject to static interference. Static, of course, is most prevalent in bad weather, just when the pilot's need for dependable radio guidance is greatest.

UHF radio ranges are now operated by the CAA along the New York-Chicago airway as a service test system and other installations are under way, with the ultimate goal the conversion of the entire 35,000 miles of airways. Airports have been ordered by the Federal Communications Commission, acting with the advice of the CAA, to install UHF transmission equipment for traffic control. An instrument landing system operating in the UHF band is in existence at Indianapolis. Similar systems are being installed at Washington, Atlanta and Oakland, Calif., with five more in process of manufacture and due to be installed at New York, Cleveland, Chicago, Kansas City and Los Angeles.

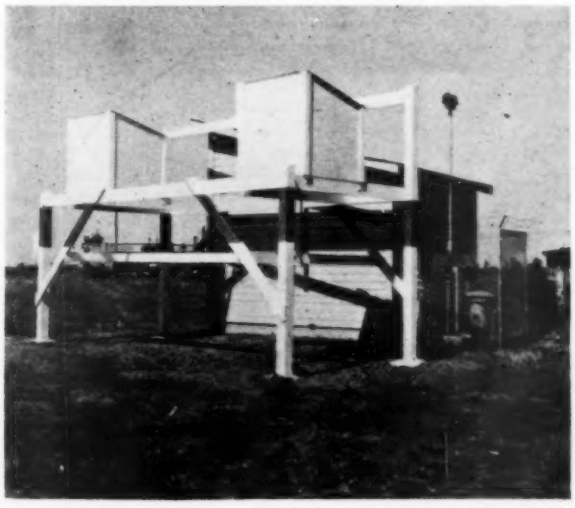
The instrument landing system is a triumph of CAA technical development, culminating experiments which began back in 1928. One simple dial enables the pilot to see at a glance whether he is taking the proper course for a landing, even though the airport may be enveloped in fog.

But this is only one phase of CAA technical development

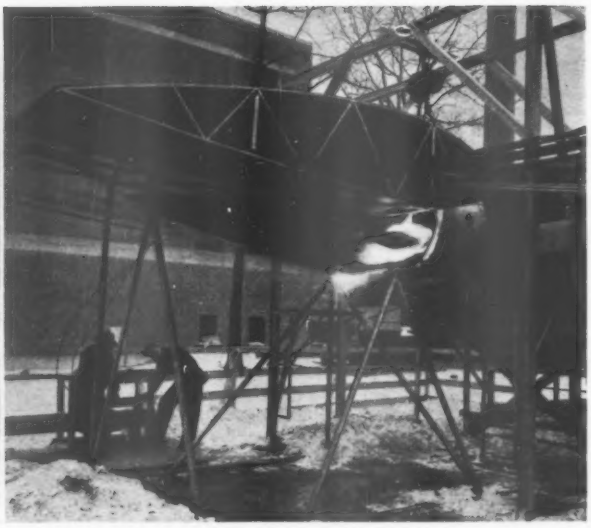
Plan of CAA's instrument landing system at Indianapolis. Radio markers enable pilots to orientate their position.



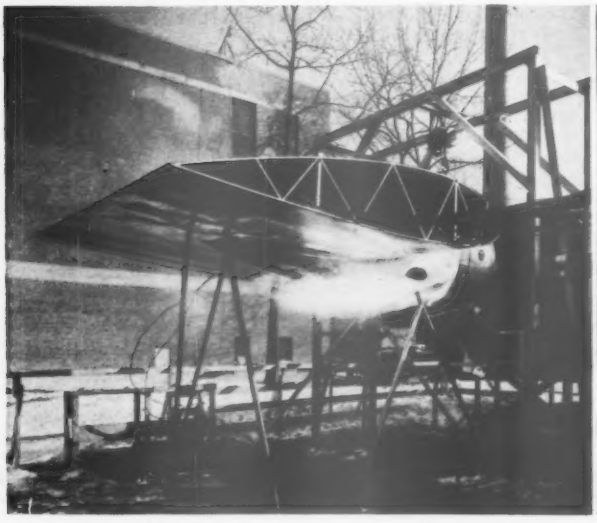
Glide path transmitter. Four were used for Indianapolis system, as indicated by black dots on adjoining diagram.



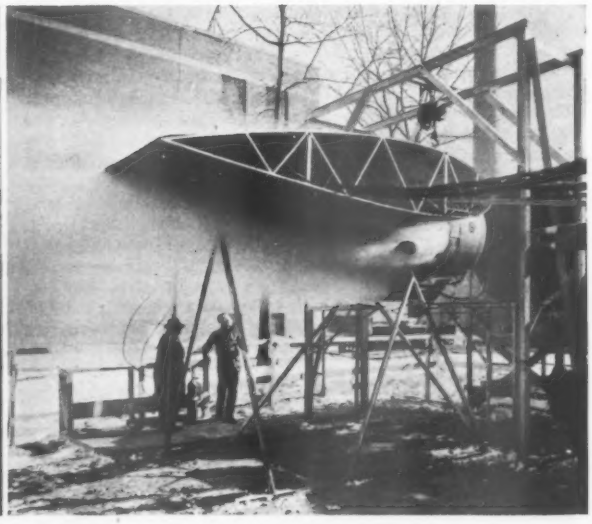
1 Means for detecting and extinguishing fires in flight is new CAA project. Experimental set-up above includes nacelle and wing section facing mouth of wind tunnel.



2 Switch is thrown, starting oil fire in vicinity of engine cylinders. Picture shows intensity of flames after few seconds. This particular engine is a twin row 900 h.p. "Wasp."



3 Flames roar back as would occur in actual flight as air from wind tunnel flows over nacelle at 70 m.p.h. This test equipment has been subjected to 1,800 fires.



4 Carbon dioxide has been led to engine through copper tube. Gas shoots from small holes, extinguishes fire. CAA engineers watch closely, check results as test is ended.

activity. To make airports more serviceable, a special section studies problems of soil stabilization, drainage, paving, lighting, etc. The up-to-the-minute Washington National Airport incorporates many of its findings, notably in the lighting system, which directs pilots to the proper runway for landings, as shown in an accompanying photograph.

Another section specializes on problems relating to aircraft. Right now, for example, it is working toward means for detecting and extinguishing fires in the air and for the design of fireproof construction. Indicating the thoroughness with which such work is conducted, the test nacelle and engine have so far been subjected to at least 1,800 fires. Also under development are a stall warning indicator; photographic equipment for measuring aircraft performance; an automatic instrument log using infrared film to avoid disturbing the pilot's vision; and apparatus to detect, measure and analyze flutter and vibration, which are particularly important in today's larger and faster aircraft.

In addition, an aeronautical charts section devises new types of charts to "keep 'em flying" safely under changing conditions. Thus charts have been developed especially for instrument flying and approaches and landings, as well as fluorescent charts for night operations.

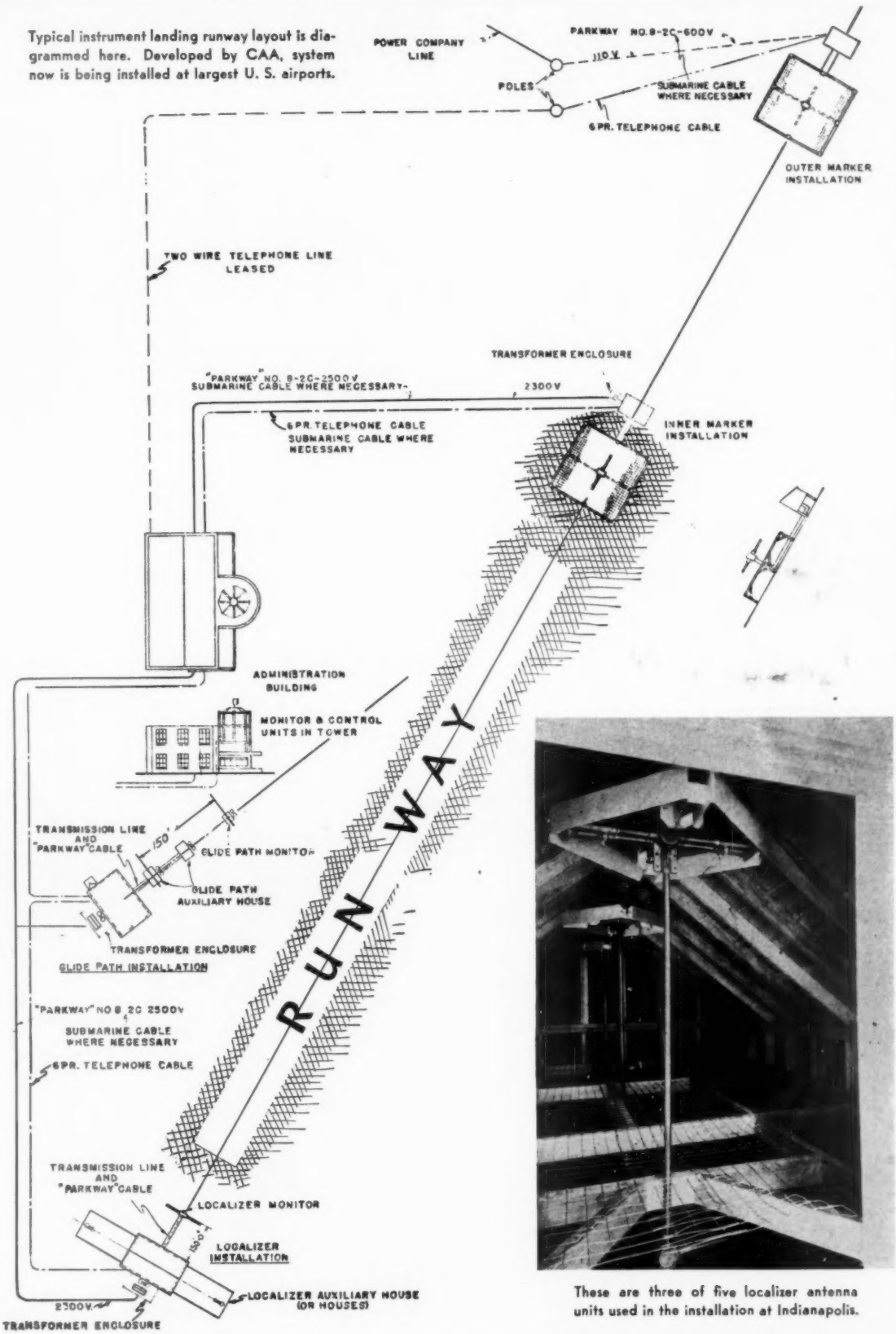
All products of the Technical Development Division are subjected to rigid practical tests at an experiment station adjoining the Indianapolis airport.

While rendering continual service to war needs and commercial aviation, the division does not forget the needs of the private flyer. In all of its development work these needs are carefully considered and many of its projects are designed especially to help him.

This great variety of research is carried on by a handful of faithful career men whose contribution to the advancement of flying in these United States, if it could be measured in dollars and cents, would run into hundreds of millions. At a time when the fate of the nation may well be determined by its air power, their services are beyond price.

END

Typical instrument landing runway layout is diagrammed here. Developed by CAA, system now is being installed at largest U. S. airports.



These are three of five localizer antenna units used in the installation at Indianapolis.

FACTS ON FLYING

This organization is charged with the compilation of all statistics and data pertaining to U. S. civil aviation.

Facts compiled by the Information and Statistics Service help Governmental branches and the industry gauge trend of aviation.

by
ROSCOE WRIGHT

Director of Statistics and Information for CAA since August, 1940, Mr. Wright has many years' experience in journalism and allied professions as background for guiding diversified activities of his office. Born September 20, 1899, in Tipton, Ia., he majored in English composition at Grinnell College. In Government service since 1936. Mr. Wright is a licensed private pilot.

THE authors of the Civil Aeronautics Act of 1938 which created the Civil Aeronautics Authority (and which still provides the statutory basis for the operations of the Administrator of Civil Aeronautics) took a broad and long-range view of the needs of civilian flying. They realized that the promotion of this swift new medium of transportation was important to the nation. And they recognized that while Government could provide basic help toward the attainment of this goal through the promotion of safety, these services should be supplemented by a program of public education.

A state of war is certain to result in restriction or interruption of activities designed to give information about aviation facilities. Already this necessity has been felt to some degree by the CAA. But the purpose here is to describe the normal functioning of the educational staff within Uncle Sam's official administrative agency for civil aeronautics.

The Administrator of Civil Aeronautics is specifically instructed to carry on such activity in the language of the law itself. He is "authorized and directed to foster and encourage the development of civil aviation and air commerce," and "to disseminate information" which will help him attain this objective. On the basis of this authority from Congress, he maintains as a branch of his administrative staff an "Information and Statistics Service." It is the job of this Service to keep on file all the essential facts about American civil aviation, to keep those facts up to date and to spread among the American people, as widely and as frequently as possible, accurate reports which will indicate the progress of civil flying.

True, the forward steps in civil flying often are closely related to the operations of the CAA. Flying is safer because of the aids to navigation on the civil airways. It is safer because of the hundreds of airports now being built or improved. It is safer because of the care with which both planes and pilots are inspected, and because of the controlled flight training course devised by the CAA.

But the great majority of the actual impulses which are pushing civil aviation forward toward its inevitable place in

Copies of regulations, manuals and other data flow in steady stream through busy mail room of distribution unit.

the pattern of this nation's transportation originate in the industry itself. Yet they, too, in the light of their stimulus upon the growth or increased stability of civil aviation, must be accounted for in the progress reports of the CAA information service.

The reports of this office fall into two main categories. The first of these is information for the "trade"—that is, for those who actually fly either for business or pleasure, or who are directly related to aviation in such fields as manufacturing or service, the publishing of trade journals or the teaching of aviation. These we consider the professionals and the "semi-pros." For them are published such informative brochures as the bulletin "Air Navigation Radio Aids," which catalogs the communication facilities for pilots in flight; the "Weekly Notices to Airmen" which warns flyers concerning current ground hazards; the Directories of Airports and Seaplane Bases; the Civil Aeronautics Journal, published jointly with the Civil Aeronautics Board, and the various CAA technical bulletins, textual matter for which is developed in the technical divisions of the agency. These combined services make this office the nation's official air travel information center; and the best proof of how thoroughly these data are used is the flood of correspondence which follows commission of even a minor error.

It should be emphasized that the sole basis for issuing such data is public demand, which has been gaged by the multitude of inquiries during the 15 years in which the Federal Government has had any machinery to provide such information. The publications cited here have been developed as the most economical and satisfactory manner of answering large blocks of questions which otherwise would have to be handled individually. As any business man knows, the personal letter is one of the most expensive means of spreading information.

There remain, of course, multiplied thousands of inquiries which require individual handling. Their bulk is so large as to require a special correspondence unit, and the facts must be developed through the aid not only of a statistical section but also a compact aviation library and research service.

The inquiries cover a tremendous range. They are both technical and general—where to get industrial, mechanical or pilot training . . . what schools are good . . . where and how to get model-building help . . . what to do about a disobedient daughter who sneaks off to take air-rides with her boy-friends . . . amateur inventors with "revolutionary" new devices . . . an airline sleeper-passenger who fears the paper shield over his night-light is inflammable and sends sample (it is fireproof) . . . a wife trying to locate an errant pilot-husband last heard of in Peru . . . all degrees of rumors, knocks and boosts—and, of course, a good solid majority of sensible (though often difficult) questions.

As the number of registered airplanes, pilots, instructors, mechanics and other personnel multiplies year by year, it is being found more and more necessary to "mechanize" the filing system from which facts about them may be obtained. That is, these basic facts are translated into series of holes punched in standard file cards, so that the required statistics may be obtained by running these cards quickly through mechanical sorting machines which compute the figures.

As simple examples of this work, you may wish to know how many of the country's 100,000 accredited civil flyers are private pilots, how many are commercial pilots and how many have transport "tickets." You may need to know how many women pilots are authorized to fly multi-motored aircraft, or

Bulletins and maps are issued periodically by CAA and distributed to airports and pilots for instructions.

indeed, how many of the certificated airplanes in the United States have more than one motor. You may wish a breakdown of all accredited pilots into the heaviest types of aircraft they are authorized to fly. There are, of course, literally hundreds of other requests concerning airmen or equipment which may be answered quite simply through this mechanical process.

The statistics produced by this unit are the *official* facts about United States civil aviation, accepted as such by the aeronautical year books, textbooks and the encyclopedias. The utmost care must be exercised in compiling such source-material. In fact, our figures even have been used consistently by actuarial experts in their difficult task of establishing equitable rates for all types of aviation insurance coverage. Incidentally, for economy's sake, this same group of tabulating machines and operators "double in brass" periodically by serving the personnel and cost-accounting units of the agency.

The other type of information, as contrasted with that destined for the "trade," is prepared for the general public, the great mass of people whose interest in aviation is as yet perhaps slight, but whose ultimate participation in it to some degree is vital to the future of the industry. Indeed, this mass participation may in the long run be vital to the future of the country.

This type of reports and releases is written in the laymen's language and often supported by illustrations. It is designed to make clear to the average man or woman the facts about American air progress. Air travel becomes less mysterious when it is realized that about four million passengers travelled by air last year. The hazards of learning to fly achieve a more proper proportion when it is understood that more than 75,000 CAA courses have been completed with only 27 student fatalities. The fact that all types of insurance covering flying are being steadily reduced in cost constitutes valuable knowledge so far as the future of civil aeronautics is concerned.

Here as in the technical field the yardstick of all activity is public interest as expressed in inquiries. Those inquiries come from the hundreds of newspaper correspondents in Washington, from special aviation writers of all types, from radio and motion picture concerns, from students and authors and educators, from members of Congress and other public officials and from thousands of just plain citizens.

The improvement of several hundred important airports, or the letting of training contracts to hundreds of colleges and flying schools, generates intense and widespread interest. There are almost endless inquiries concerning what communities will be selected, how the selections will be made and in general what the yardsticks of eligibility will be.

Other matters, far removed from a direct administrative relationship to the CAA, also pique the curiosity of the general public. For example, in the fall and winter of 1940 there were several unfortunate airline accidents. Statistically, these accidents did not mean a setback in the marvelous safety record achieved by the airlines during that year. Actually, in relation to the more than 3,000,000 air passengers carried, the year 1940 was the safest in air transport history. But there had been during the Spring months a bitter controversy over the reorganization of the CAA; and a few of those who had opposed that reorganization most bitterly (but unsuccessfully) greeted each mishap with loud shouts of "I told you so!" As the result, a multitude of people unaware of the industry's steady improvement in safety, became unduly alarmed and flooded Washington with questions. Thus, while the operating services of the CAA were adopting heroic measures to check every possible source of trouble, the Information Service reported to an alarmed public that on the basic of cold facts, air travel was growing progressively safer. Facts are the only ammunition used; and in the long run, the facts will speak for themselves.

The question periodically arises as to why, if the truth eventually will prevail, it is necessary to have people on public payrolls to state the facts over and over. This is a fair question, but the answer to it is only part of the larger question. That is, if a transportation system is economically sound, why should it be subsidized with public funds during the period of its struggling infancy, or even longer?

The answer, with precedents going back to the early days of this nation, is our traditional impatience as a people to develop and move ahead. The improvement of our harbors

CAA bulletins, regulations, technical reports and specifications comprise an important part of that organization's duties.

meant a stimulus to our industry and our shipping, so we subsidize them. Better inland waterways meant the opening up of rich interior areas, so we developed them. Transcontinental railroads meant the colonization of the West, so we gave them tremendous land subsidies. The greatest beneficiary of all has been our system of highways, but I believe few people regret one cent of it because of the pleasure and culture it has brought to millions of citizens, as well as the tremendous industry which has resulted both for the employment of people and the investment of capital.

Spending public money to provide facilities and ease the burden for civil aviation is nothing more than a continuation of this tradition, but just as the airplane is the fastest means of transportation, so its development has been the most rapid by almost any yardstick you might care to apply. There has been more air progress in the three and one-half years since the Civil Aeronautics Act was passed than there had been during the 38 years since Kitty Hawk. Mr. Hitler had of course, an unwitting but important role in this. He was instrumental in frightening us into our defense effort just as he and his allies today are the primary reason for our conducting the biggest aviation program ever undertaken by any nation in the history of the world.

With the declaration of war, the three and one-half years of preparation stood us in good stead. Indicative of our coming air supremacy was the fact that all planes destroyed in the "stab in the back" attack at Honolulu were promptly replaced by others coming off the assembly lines in the United States. They will continue to come off in increasing numbers for the duration of the war.

And for the duration of the war the Information and Statistics Service of the CAA will continue the all-out activities to aid the war effort which were instituted at the opening of hostilities. As every pilot knows, every civilian flyer in the country was grounded when the war began. It fell upon the CAA field workers to establish the citizenship and loyalty of everyone able to fly. Behind that effort was another that kept the Information and Statistics Service going day and night in order that factual data on our thousands of planes and pilots might be supplied to the proper authorities to insure the safety of private flying in a minimum of time and with a minimum of red tape.

Equally necessary and equally rapid-fire was the informational response to requests pouring in from the military for complete information on airlines, radio services and similar facilities under the CAA so vital to the war effort.

Duties like these are the primary responsibility of the CAA Information and Statistics Service for the duration.

It follows that there is only time for a brief glance at the future. It is a glance which this writer bases upon two premises —victory and the future progress of American aviation toward world leadership.

This implies an all-out additional effort which should match that now going forward to insure victory. If we are to take full advantage of the factories which have now been built to win the war in the air—if we are to "Keep 'Em Flying" when peace finally returns—we must face certain fundamental facts. In spite of the page-one publicity which it is getting today, the airplane is still a mysterious and somewhat awe-inspiring thing to millions of our citizens. Human flight is still a fearsome thing to them, bordering almost on the supernatural. Yet if the vast aviation industry which this country now is building can be converted to civilian purposes after the war, thus avoiding wholesale unemployment and tremendous capital losses, it will only be because these reluctant millions of people somehow have been reached with a true concept of the pleasure and the safety that are to be found in the modern airplane.

This is the secondary objective—secondary only to the war effort—toward which the CAA Information Service, along with a multitude of private agencies, will eventually work. It is an objective which has as its stake not only the jobs of hundreds of thousands of workers, the soundness of tremendous investments and a marked advantage for American business in the post-war trade of the world; but also the future welfare of civilian flying in the United States and undreamed-of pleasure in times of peace for a multitude of groundlings who never have tasted the exultation of soaring above the earth and acquiring, in life, a new dimension.

END

For Safety

(*Continued from page 40*)

plane, or the whole plane. If they find this still inadequate to support a decision as to the plane's safety, they may require additional tests or changes in design.

One type of test involves construction of duplicate parts of the structure under discussion—wing or control surface or landing gear. These parts are then tested in a routine manner to determine whether they will bear up under the stresses to be encountered in operation. Some parts are tested to destruction with the engineers observing carefully all aspects of the failure and the load it withstood before breaking.

In its determination to see to it that only safe airplanes are manufactured and sold in the United States, the CAA may require any new plane to go through most severe tests. To stress analyze or strength test a complete plane costs a considerable amount of money and companies which start with a shoestring, or the pilot who builds his own plane in the backyard, frequently cannot leap this hurdle. It sounds a bit harsh on the ambitious builders, but it is a policy that has paid dividends. Year after year the number of accidents caused by structural failure has dropped until it is now a negligible cause of aviation accidents. The detrimental effect of such an accident on the public justifies even the severe treatment some new airplanes receive from the engineer inspectors.

Having decided the aircraft meets the structural and design requirements the Aircraft Engineering Division advises the Flight Engineering and Factory Inspection Division that the prototype is considered safe for the critical test flights. Here the engineering inspectors—sometimes called the test pilots of CAA—take over and ascertain that the airplane meets all the regulations as to performance, handling qualities and operation.

CAA program led to sharp rise in total certificated aircraft.

Here is an exclusive group whose work might make the average man shudder, or the average new pilot envious. They test flight everything, from a glider to a Clipper. They even test many a military plane so that the manufacturer may know whether his plane will meet commercial standards when he wants to convert it for peaceful use.

Throughout the country there are 18 of them. Almost every flight they take is new and interesting and thrilling. Not long ago, a huge seaplane was up for its type certificate. It was designed for transoceanic flight, had capacity for several score of passengers. Safety with such a plane must always be the first consideration. The CAA inspector wanted to know what such a plane would do in a stall. After some protests it was finally decided to stall the airplane and find out just what would happen if such a plane got into a stalled position; what the pilot would have to do; what would happen to the passengers. The big ship behaved like hundreds of its little brothers. It wasn't dangerous at all and, after it was all over, the company was just as pleased, if not more so, that such tests had been conducted and actual facts obtained on its safety.

Experienced aeronautical engineers can usually determine in advance whether a plane will have "flutter" conditions—whether wings or control surfaces will flap about in the air like a piece of paper before an electric fan. However, this problem is still a major one and even though exhaustive "jiggle" tests are conducted the problem may be passed on to the flight inspector who takes it into the air to find out. It is not amusing to sit in a plane and try to develop flutter in the ailerons or tail surfaces. Sometimes one flutter is the *last* one and control surfaces shake themselves right off. Then the test pilot takes to his parachute.

After the Aircraft and Flight Engineering Divisions okay the model for a type certificate, the factory inspector is kept busy ascertaining that each subsequent airplane is built according to approved drawings.

These days of emergency are keeping the CAA inspectors busy. Despite the emphasis on military planes, production of commercial planes the first six months of 1941 was up 65 per cent over the same period of 1940. Production of Army planes is booming and the CAA inspectors have frequently been called in to flight test transport type and trainer planes, these being the kind they are also testing for use in commercial aviation.

At major factories making commercial airplanes, CAA inspectors are stationed permanently. In all, there are 47 of these. They submit their reports, along with those of the flight inspectors, to engineers who analyze the criticisms and recommend changes in design and structure where that is indicated in the name of safety.

Sometimes only after a plane has been in service will certain defective elements of design show up. These may be exposed after an accident, or reported by mechanics who regularly service those planes. The CAA can immediately ground all planes of that type until repairs are made. However, following our policy of co-operating with the industry the Aircraft Engineering Division informs owners by registered letter of the defective or inadequate part, and advises them to make replacements or repairs before flying their plane again. In the case of unusual flying characteristics, the CAA may place in the planes placards which show the maximum speed allowable under certain conditions. The operator is then required to keep that placard prominently displayed in his plane.

Engines, propellers and appliances must also pass the critical eyes of trained specialists before the much desired type certificate is obtained.

One of the most illuminative of CAA publications was a pamphlet, "Load Factor Information for Pilots," telling them what their planes were designed to do, what stresses and loads unusual maneuvers impose upon a plane, what conditions to avoid, how to detect the effects of undue strain and a general description of the strength of various types of plane structure. Copies of this informative pamphlet can be obtained from the Aircraft Engineering Division.

The Civil Aeronautics Board ruled that after December 1 last *all* airplanes and airmen must be certificated by the Federal Government. This rule, while it may have caused some sorrow for proud owners of antiquated aircraft and a great amount of extra work for Safety Regulation, was considered as entirely essential to safe operation of aircraft all over the country. Today there are several states in which the law does not require a pilot or an airplane to be certificated. Thus any person could fly any kind of a plane within the limits of that state. Since December 1, this picture has completely changed. The matter was carefully studied and every effort made to make this transition as painless as possible without, of course, sacrificing safety.

END

Airways

(*Continued from page 50*)

nearby frequency. As a result of the research work in the ultra high frequency spectrum it was found the ultra high frequency band was comparatively free of static and the band was of sufficient width to accommodate all our anticipated frequency requirements. Therefore, a series of ultra high frequency radio range stations were established on the Chicago-New York airway during the last fiscal year for service tests. These stations parallel the existing intermediate frequency radio range stations which have remained in operation pending the final results of the service tests. These results were so encouraging that we have now been authorized to construct 57 additional stations on the Federal airways system where the present frequency congestion is most acute. It is planned to continue the installation of ultra high frequency ranges until the existing system has been completely paralleled by ultra high frequency facilities.

In a similar manner the radio landing system has been developed to the point where its practical use on the airways has been amply demonstrated. These landing systems consist of a directive radio range facility which operates as a runway localizer and ties in with other adjacent radio directive facilities; an independent radio "glide path" which gives the pilot his position vertically above the ground and provides a path which conforms with the glide angle required to effect an instrument landing, and two radio markers, one of which is located at the end of the runway and the other approximately three miles from the end of the runway. Both of these markers are exactly on the line on which the runway localizer is projected and serves to give the pilot an indication of his progress toward the runway during the approach procedure. At those airports where radio landing systems are available the localizer course will be directed to line up with the instrument runway and will also intersect the airway line-of-flight so that a pilot who wishes to land on the airport will depart from the airway at the point of intersection and by following an established procedure will proceed to the airport utilizing the radio landing system in its entirety and permitting through traffic which may be by-passing the airport to proceed along the airway.

A somewhat similar arrangement of facilities will be provided at those airports where a radio landing system will not be available, with the difference that an additional ultra high frequency radio range station similar to that established along the airways will be substituted for the radio landing system localizer and will operate on low power, thereby serving the same purpose.

Outer and inner markers, similar to those associated with the radio landing systems, will be installed and this combination will provide all but the glide path unit and can be used in much the same manner to effect approaches and landings, except in cases of extremely adverse conditions. In many cases a special system of approach lights will be installed to assist in completing a landing by visual contact at those points where the glide path has not been provided.

It is also proposed to provide separate ultra-high frequency channels for local airport traffic control, and at the more important and busier terminals additional channels and equipment will be required to handle communications over a radius of approximately 30 miles. The basic principle of this type of control will be to give instructions and information on aircraft movements to pilots approaching such airports where traffic congestion requires this type of service. This system of control has been under development by the CAA at the New York Municipal Airport and has proved its effectiveness in reducing air traffic delays and avoids the necessity of "stacking" in-bound aircraft.

In general the Federal airways system of the future will retain the present lighted intermediate landing field facilities, teletype service, and will follow approximately the same routes now equipped with air navigation aids except in those cases where such sections have been outmoded and certain existing bends in airways can be eliminated in favor of direct routes. The many advantageous and desirable features of the ultra high frequency radio ranges indicate that eventually this type of facility will not be operated in the intermediate frequency band. The ultra-high frequency radio range and radio landing system programs will be co-ordinated with the redesign of the entire airways system on a national scale with emphasis on direct routes, improvements at airway junctions and the expeditious handling of traffic.

These refinements will constitute still another major advance in a constant effort to serve the present and anticipated future needs of private flying, scheduled air carrier operation, and the aeronautical activities of the armed forces on the Federal airways system.

END

Aviation in the U. S.

(*Continued from page 37*)

nearly one-third of it in Federal work projects, and we had a $50,000,000 Federal airways system. The safety of airplane performance had been improved substantially, both in air transport and private flying. The industry was ready for a light breeze in the right direction to send it into unparalleled expansion. The CAA provided that gentle "zephyr" which within two years had been expanded by the defense emergency and the war into a regular hurricane.

Airport construction, airways improvements and pilot training are piling up at a rate which was unpredictable three years ago. Even now the rate is not enough. The airlines, urgently wanting more and newer equipment to handle the record passenger volume, are temporarily distressed; but they too will benefit greatly in the long run from the new facilities, as well as from the rapid improvement in large-plane performance.

The all-out intensity of our military effort will carry aviation forward with giant strides; but the struggle for air supremacy will not end when the shooting stops. Immediately it will shift to civilian commerce, where speed will be a basic factor both in the resumption and the servicing of normal trade.

This country will be ready for that post-war competition with the greatest productive aircraft industry the world has ever known. We will continue to operate the best airlines in the world and again we will sell in world markets the best airplanes made anywhere. Our foreign airlines will carry larger and larger varieties of American goods for export.

But the backbone of our aviation business, as is true in nearly every commercial field, will be right here in the U.S.A. Our failure, if indeed we fail at all, will be domestic—failure to somehow capture the interest of the 90-odd per cent of our people who have not yet flown either as passengers or pilots.

That is exactly where we have failed all along. We have failed to condition the public to using the "ocean of the air." Hitler, through the German school system, achieved in four years more than twice as much "air-conditioning" as we had managed since Kitty Hawk. By 1938 he had 250,000 pilots and student pilots in his National Socialist Flyers Corps. Of course he did it by regimentation, but the fact remains that he used the regular educational channels.

Contrast this with the fact that, three years ago, there were only 10,000 civil aircraft of all types and 23,000 qualified pilots in the United States.

Then we, too, began to see that our problem was one of education. Despite centuries of dreaming about it, the air is still a strange new element for man. The most effective way to accustom him to it is to let him grow up with it, acquiring an early understanding of its principles, history and progress. Because there was no accepted expression for this, I chose to call it "air-conditioning." This is not a play on words or a wisecrack. The verb "to condition" means the attitude or state in which a person exists. The difference between being "conscious" of the air and "conditioned" to it is the difference between theory and practice. Our job was to add firsthand practical application to the theory.

Educationally, we have only begun. The chance to acquire air wisdom must be extended below the colleges to the high schools and even the grades. With total war—and total victory—our immediate goal, time is of the essence. Only through the schools of the nation can the airplane be made, soon, another great progressive force comparable to the motor car.

END

Flying Is a Business

(*Continued from page 43*)

teletype is not used but the information is sent over radio circuits by radio telegraph. Radio ranges and communications stations have been established in the Hawaiian archipelago, and radio communications stations will soon be in operation on a number of even the remotest islands of the South Pacific ocean.

High-powered radio communication stations have been established to provide direct exchange of weather and flight information between Anchorage, Alaska, and Seattle, Wash.; between San Francisco and Honolulu, the mid-Pacific islands, and eventually Australia, New Zealand, the Phillipines and Asiatic routes; between Sayville, N. Y., and Newfoundland, Portugal, the Azores, Bermuda and eventually many European points; and similar facilities are now under construction at New Orleans for the exchange of information on weather and other matters vital to safe aviation between points in the Caribbean area, Central America and the northern portion of South America.

Back of all this system of airway aids, with their complicated devices, is a small army of trained men daily engaged in the exacting task of inspecting, servicing, repairing and otherwise maintaining them, so that they may be always in condition for dependable mechanical operation, and another small army of men trained to expertness in radio and teletype communication.

The CAA is now undertaking the conversion of its vast radio range system from intermediate to ultra high frequencies, using visual, in lieu of aural, course indication; and is commencing service installations of instrument landing systems, sometimes erroneously referred to as blind landing systems—erroneously, because it takes good eyesight to see and co-ordinate the readings of the flight instruments necessary to accomplish a good landing.

The preliminary experimental and development work necessary to devise and test such improvements requires a Technical Development Division which devotes all its time to research and development of new and better flying aids. By co-operation with some of our great universities and our manufacturers of scientific material, the nation's laboratories and factories have been utilized in the effort toward progress.

As business grew and more people were flying the airways, something had to be done about controlling traffic.

The first control of air traffic by the Federal Government was inaugurated on July 6, 1936, when three airway traffic control centers previously established by several of the air carriers were taken over. These centers were subsequently increased in number each year, looking toward the ultimate objective of providing airway traffic control protection over the entire civil airway system of the United States. This objective will be realized by the end of the fiscal year 1942 when there will be in operation 23 airway traffic control centers, each controlling an average of approximately 1,500 miles of civil airways.

From the modest beginning in 1936, air traffic control has been extended so that there are now in operation 14 control centers, whose areas of control cover more than half of the United States, and from funds recently appropriated by Congress, nine additional centers will be established during the next few months, extending the control zones to all sections of the country.

During the calendar year of 1938 the Air Traffic Control Service controlled 300,000 aircraft movements. During 1941, the number of such movements was approximately 2,000,000. The rate of increase indicates that approximately 4,000,000 aircraft movements will have to be handled by 1943; 15,000,000 in 1945.

The control of air traffic on airports is a more recent activity of the Federal Government. On November 1, 1941, the Civil Aeronautics Administration commenced operation of eight airport traffic control towers. By next spring there will be approximately 40 such towers in operation. Airport traffic control towers are being operated by the CAA only at airports where such operation has been certified by the Secretary of War or the Secretary of Navy as being essential to the national defense.

To plan and develop procedures, technique and facilities to meet successfully the problem of these increases in air traffic is one of the major objectives of the CAA's Air Traffic Control Division. Contributing to the solution of this problem are included automatic flight data posting systems in airway traffic control centers (the first of such systems already has been installed at the Washington center); approach control facilities and procedures to permit time separation between successive aircraft making instrument approaches of two to five minutes as compared to 10 to 15 minutes as required at present; improved traffic control communication service. By the end of this fiscal year each airway traffic control center will be connected to all important aeronautical communication agencies and aircraft operators in its control area by direct telephone service consisting of approximately 30,000 miles of leased wires. It is hoped that several other devices which are at present in an experimental stage will also be of assistance in coping with future air traffic control problems.

Meanwhile, and understandably, the Bureau of Safety Regulation has expanded many fold. Where it was formerly necessary to inspect and approve only a few types of planes, the vast increase in their variety has made the work of safety regulation far more technical and widespread as the years have gone by.

Similarly CAA's work in the field of airports has greatly expanded. It began in 1926 to rate airports in the nation and during the pre-depression years served in a consulting capacity to local governmental and private interests which were building airports at that time. During the depression, it acted in a similar capacity for the Government airport program and in 1940 was designated as the executive clearing house for a greatly expanded airport program co-ordinated with the general defense effort. This fiscal year with the approval of the Secretaries of War, Navy, and Commerce, CAA is in charge of a program involving the expenditure of more than $100,000,000.

Nearly 3,400,000 miles flown is record of "Ham" Lee, famed UAL captain and air transport pioneer.

Another new development has been in the field of pilot training. Begun experimentally in 1938, it was originally designed to train pilots as a developmental move to encourage interest in flying and benefit the builders of light airplanes. A year later the program was co-ordinated with the defense effort. By fall of 1941 a total of 92,367 trainees had received instruction in the CAA pilot training program and an additional 16,890 began training in the fall, raising the total to 109,257. Courses contracted for to date out of this fiscal year's funds alone totaled an expenditure of $17,226,781.

The Civil Aeronautics Board now issues certificates of convenience and necessity for new or revised routes, establishes the air mail rates, formulates the Civil Air Regulations, and investigates accidents for determination of probable cause and means of reduction.

The Civil Aeronautics Administration enforces the regulations; establishes, maintains, and operates the Federal airways, including traffic control; conducts technical development; inspects, tests, and certificates airmen, aircraft, engines and accessories; conducts the civilian pilot training program; and administers the Federal airport development program.

An indication of how tremendous this task has become is found by glancing at current aviation progress. In 1938 aircraft production was valued at $125,000,000. In 1942 it is expected to exceed $3,000,000,000 and owing to curtailment of automobile production will probably rank second only to steel.

In this tremendous and exciting development, we all had to start from scratch and work up, step by step, by trial and error—although not so much error as might reasonably have been expected. But it was a trial and error which did its share in making U.S. civil aviation the world leader that it is today. And there is no longer any reasonable doubt that flying is a business.

END

Modern aircraft, like this Luscombe, can be stalled only if pilots ignore planes' many warning characteristics.

Quit Stalling!

by John R. Hoyt

CAA reports show the unintentional stall is responsible for many accidents. Here's how to prevent it.

IN reading the reports of the Civil Aeronautics Board regarding accidents, it soon becomes apparent that pilots are getting into trouble because they *stall* unintentionally. For example, read some of the typical cases taken at random from a few hundred reports:

(a) The pilot took off for a local flight. When the aircraft was at an altitude of approximately 200 feet the engine lost power. The pilot selected an alfalfa field and approached it in a shallow gliding turn. He undershot the field and the aircraft was stalled at an altitude of about 75 feet. The plane fell to the ground striking on the landing gear and nose at an angle of about 40°.

(b) A stall and a spin during a low-altitude turn caused an accident in Michigan. A glider pilot started a slow left turn, nose high, fell into a spin and crashed.

(c) A stall after a climbing turn at low altitude caused a crash and fatal injuries to Pilot S. In attempting a right turn at about 500 feet, the aircraft stalled and fell into a right spin. Partial recovery was effected at about 150 feet after two turns in the spin. The aircraft continued to settle until it struck the ground in a near level flying position and was demolished.

(d) Pilot C. landed at an airport around 5 p.m. Almost immediately he took off, made a 180° left turn, and flew back over the field at low altitude. When the airplane was about 300 feet beyond the boundary of the field the engine cut out. The pilot started a left turn, in an obvious attempt to return to the airport, but the plane stalled in the turn and entered a left spin, completing about half a turn before striking the ground, almost vertically, on the nose.

Case after case reads the same. In almost every instance the plane was stalled, leading to an incipient spin and terminating in contact with the ground before a recovery could be effected. In almost every case the CAB stated:

PROBABLE CAUSE: action of pilot in losing control at low altitude.

CONTRIBUTING FACTOR: inexperience of pilot.

It is fairly well understood by the flying coterie that modern planes of conventional design do not fall out of control or enter an incipient spin through sheer whimsey. Something must be done in order to make a plane spin—as anyone who has passed his private pilot's examination will testify. Moreover, spin recovery is so simple in a lightplane that it may be effected by the expedient of relaxing the controls. This may not be considered as precision flying, but it works.

In other words, the remarks of the CAB are very pertinent indeed. The pilots involved in those accidents lost control of their planes, and they did so due to inexperience. But unfortunately, flying cannot be learned by taking good advice—it must be learned by experience. And experience may be gained only by practice and constant attention to rectify mistakes.

It has been stated that the period following solo is the most dangerous part of a pilot's life. That bit of irony is all too true, and most pilots get worse around the 75-hour stage. With no check flight, no practice or correction, they skid merrily on until a low altitude turn affords another opportunity for a CAB report.

At this point two questions arise. First, it may be asked, why do modern planes spin in? If it is true that they must be spun with a definite technique (for example the "105" or J4F) why should pilots "spin in"? The answer is that the spin is incipient, which Webster defines as "beginning to show itself." It isn't ac-

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Pilots' Paradise

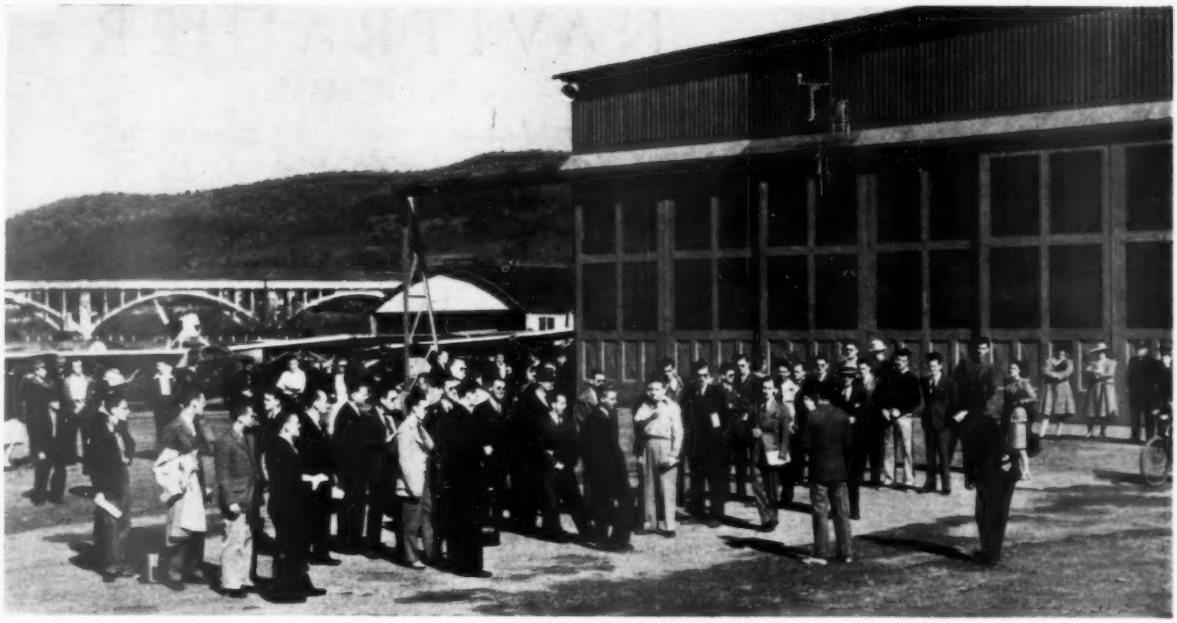
By
WILLIAM D.
STROHMEIER

IT'S an amazing experience to spend an hour or so in the operations room at Cub Haven airport any day of the week and see a situation which hardly has an equal at any airport in the United States, except, perhaps, at some large Army base. For here in a map muralled room is the manifestation of the fondest dreams of any young blood who has the all-consuming desire to fly and fly a lot.

In one corner of the room are two lads awkwardly matching two adjoining section maps together to draw a course line. Cub Haven Airport is on the New York section map but if you look closer you'll see that the two maps they are working on are the Butte, Mont. and Spokane, Wash. sections. You ask them where they're going and as nonchalantly as though they were just driving into town they tell you they're taking two *Cruisers* to Seattle, where the planes will be shipped to Alaska.

On another side of the room is a young lady, slacks and all, stretching the black string, one end of which is pinned on Cub Haven, across the master map spread out on the wall. She's taking a trainer to Kansas City and is checking the gas stops along the route. A friend is giving her a lot of information and climaxes his helpfulness by even showing her filling station locations in Missouri where she can land and get

At Piper plant in Lock Haven employees learn to fly and deliver the ships they build. At top is a delivery flight formation. The ships at left are held back for delivery orders.



These employees completed greatest mass delivery, flying 48 ships in formation to LaGuardia Field.

Employee-pilots are part of a unique commercial "ferry command" at the Piper plant. They deliver ships to get in flying hours.

gas if the usual head winds out there are too strong to get to the next airport. If you listen closely you'll find that he's made the trip eight times in the last year. A little later another lad shows up and says he's going to San Antonio. And so it goes all day long, week in and week out. Young men and women and occasionally even grey-headed pilots slip into Operations, check their maps, compare notes and take off for all parts of the nation.

It's Pilots' Paradise, all right.

Who are these people who shuttle back and forth across the country? They're members of a unique commercial "ferry command," so to speak, which covers the breadth of the nation in an efficient yet colorless manner. The pilots in normal life, and they do lead a normal life between trips, are regular factory workers. One of the group we saw in operations makes his living running a punch press, another spends his eight hours a day over a drafting board, the girl is taking time off from pounding a typewriter for some official. Who are they? They are employees of the many departments in the *Cub* factory enjoying a privilege which practically no other class of workers could even imagine. Their flight missions are delivering the ever increasing numbers of lightplanes which are needed for pilot training.

The delivery system, as it is called, was instituted a year ago for about the

One out of every four workers is a pilot. Here is Roberta Sabetto, stenographer and member of the Cub Fliers. Employees get instruction cheap under Bill Piper's plan.

Foreman Elmo Maurer has 225 hours and frequently makes short delivery hops.

same reason that the Air Forces found it necessary to institute the Ferry Command to handle delivery of the greatly mounting numbers of bombers and fighters which are pouring out of the nation's aircraft plants. The Army had to put its own pilots into the service because there no longer were enough commercial pilots with twin-engined plane experience to take care of the demand for ferry pilots. Likewise, the commercial manufacturers have found the problem increasing. As Piper production rose to 100 planes a week and individual distributors began receiving ships by dozen lots, the question of how to deliver them became acute. Dealers couldn't spare pilots, who were busy on Civilian Pilot Training Programs, to go to the factory for the ships and possibly be held up by bad weather. Some other system was needed.

Mr. Piper, himself, hit on the idea of arranging deliveries by factory pilots. As a result of a long range program of teaching employees how to fly, there was a vast reservoir of capable pilots right in the company's ranks of workers. "Why not use these pilots?" he asked. Such an idea immediately appealed to dealers and distributors alike. It relieved them of the necessity of sending pilots to the factory. It enabled more prompt delivery because the minute a ship was finished it could be flown away whereas previously the ship sometimes was grounded for several days until the dealer had arrived for it.

For the employees, the plan also was a bonanza. It would give them cross country time at no cost. Everybody was happy. The system as set up has been working smoothly now for more than a year. The purchaser is charged a specific mileage rate for the delivery. A certain proportion of this charge is earmarked for insurance and the pilot is given a definite mileage allowance which is amply sufficient to meet his gasoline, hangar, hotel and return expenditures. Nicest thing of all is that the ships are completely covered by insurance, which pleases the purchasers immensely.

The fact that there are enough pilots properly qualified at the *Cub* factory to make these deliveries possible is another interesting point which makes Lock Haven the Pilots' Paradise par excellence. Most of the pilots making the delivery flights probably couldn't fly an airplane straight and level a year ago. They learned to fly where they worked and in the largest flying club in the world. The Cub Fliers, which is the name of this club, is made up of *Cub* employees who want to fly.

The club plan was originated by Mr. Piper, who felt that workers would understand their jobs better if they knew what it was like to be looking down 5,000 feet from the cockpit of one of their products. Back in 1935 at the old *Cub* factory situated in Bradford, Pa., the nucleus of the Cub Fliers was formed when Mr. Piper turned over a ship to the small group of workers who were eager to fly at that time. The entire plan of operation was set up in such a way that employees would pay a minimum amount for their flying. Instruction was

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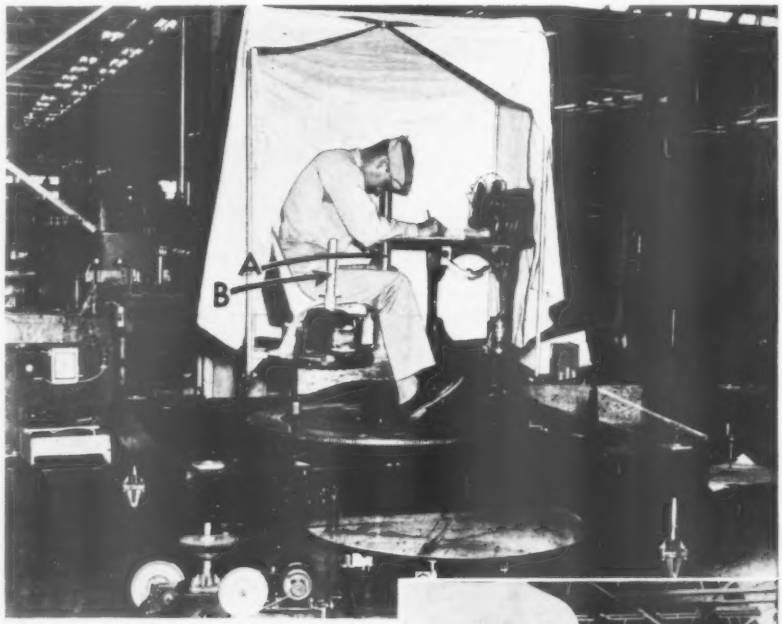
NAVITRAINER

by BEN H. PEARSE

The Army has developed a new machine that simulates flight navigation on the ground.

ONLY a few years ago, the Army Air Forces had lots of time and no money. Today things are just the reverse. There is plenty of money and too little time. But time cannot be bought, it must be saved. In carrying out its huge expansion program, corners have to be cut wherever safety permits.

The biggest corner was cut when the one-year training period for pilots was cut to about seven months, but that was not enough. Under the press of a program for 30,000 military flyers a year, further economy was sought. A saving of only one hour in a pilot's training period means 30,000 hours a year in the aggregate, two hours cut means 60,000. Figure out the saving not only in time, but in money at, say $10 an hour, a very conservative estimate. Even minutes are precious.



Student takes a reading with one of two drift meters (A and B) with which the new trainer is equipped. At right is production line in shops at San Antonio Air Depot.

Of the many refinements effected in the training program, many of them along the line of synthetic flying to save the time actually spent in the air, the latest is a Navitrainer. Designed at the Instrument and Navigation Laboratory at Wright Field, Dayton, O., it gives student flyers nearly all the elements of actual flight, including day and night navigation over water or land, and even over overcasts where only radio bearings and celestial navigation can be used.

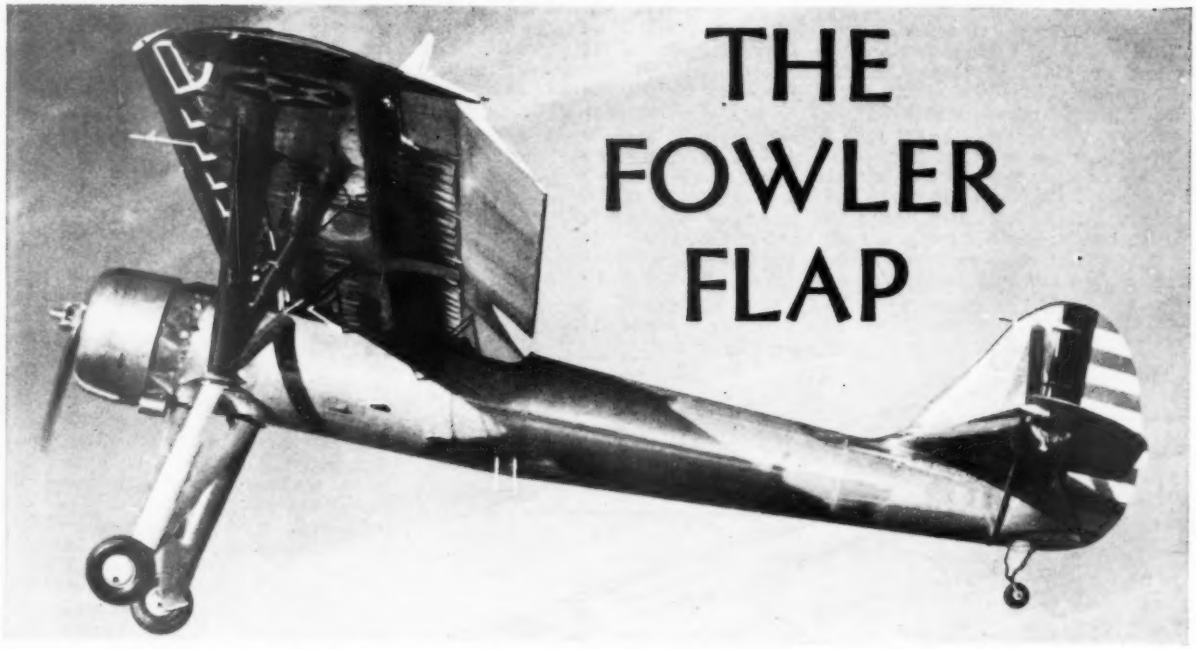
This new time-cutter has passed experimental tests. At the Air Depot at Duncan Field, San Antonio, Tex., the first group is being built for distribution to Air Force navigation schools throughout the country where it is expected to prove an aid to the training program. In addition to saving time by reducing the number of hours needed for training and the number of airplanes assigned for navigation training, it is hoped that the quality of instruction also will be improved as well.

The perfect team for navigation instruction consists of a thoroughly experienced navigation instructor and an apt student. Then the instructor can also serve as pilot, carrying out the directions of the student-navigator but checking him constantly. Under present conditions, however, there are not enough navigation instructors to have one assigned to each student.

Since the Navitrainer operates on the

(*Continued on page* 104)

THE FOWLER FLAP



A contemporary type designed around the Fowler flap is the Ryan YO-51, on which the author did initial engineering.

by H. R. FOOTTIT

One of aviation's most successful auxiliary high-lift devices is the Fowler flap. It enables planes to retain high speeds, yet fly out of small airports.

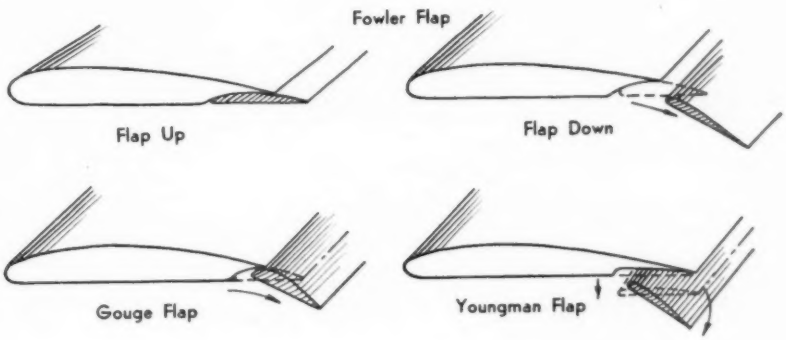
WITH 400 m.p.h. fighters boring through the sky and military powers clamoring for more and more speed we are apt to forget that these fast airplanes are only as good as their slowest flying speed. Though we must have planes that can out-maneuver, out-climb and out-fly those of other flags, the world's best fighter is useless unless it can take off and land within the restricted boundaries of bumpy, wartime flying fields with autogyro-like precision.

For ground safety and air superiority the range between landing speed and high speed must be as great as possible. In aviation's early days if we sat down at 50 m.p.h. we felt quite satisfied with a 120 top. Today we demand unlimited top speeds—300, 400 and, in the near future, 500 m.p.h.—but the landing speed remains monotonously the same. To satisfy this vigorous jump in speed range we must look to some auxiliary means of producing lift; some variable device that will produce high lift for slow landing, high lift with minimum drag for quick take-offs and the least possible drag for high speed. The more lift we can pull out of the hat precisely when required the greater will be our speed range.

This urgent demand for lift of course has been met by the slot and flap. What can be done with this powerful combination can be seen when the U. S. Army's new observation plane, the Ryan YO-51—a two-place, open cockpit, parasol wing monoplane—takes to the air. This ship, the *Dragonfly*, can take off and land on an unbelievably small piece of ground, has an exceptionally great speed range and can climb at such steep angles that the average pilot has difficulty in suppressing a shudder. For this phenomenal performance Ryan engineers relied largely on the effective lifting power of a long chord, full span, Fowler flap installation.

This flap, invented by Harlan D. Fowler, is one of our best lifting devices, though it is by no means a newcomer to the aerodynamic chess board. First introduced some years ago, it recently has come into renewed prominence on new Ryan, Lockheed and Consolidated models. Its development has progressed along parallel lines with such notable and similar lifting arrangements as the Youngman (Fairey Aviation Company) and Gouge (Short Brothers Limited) flaps in England.

The Fowler flap relies on two old lift-increasing principles: increasing the camber of the basic airfoil and at the same time expanding the wing area. In flight the Fowler, an ordinary airfoil-shaped flap, nestles in a pocket under the trailing edge of the wing. Instead of being rigidly hinged, however, it is fixed to small trucks whose rollers ride snugly in curved tracks which extend through the wing and beyond its trailing edge. When the pilot wishes to land he runs the flap out along the track so it extends backward, and droops downward, until the leading edge of the flap is just below the trailing edge of the wing. This increases the camber and area of the wing and supplies that vital additional lift with



a corresponding increase in drag. For quick take-offs, when minimum air resistance is essential, the flap can be rolled out part way so it can still boost the lift without adding excessive drag.

When the flap is out the flap track is so arranged that it allows the flap to rest a little below the wing's trailing edge. This forms a crude slot between the nose of the flap and the rear of the wing. This slot is important. The high pressure air on the wing's underside funnels through the slot into the low pressure air on the upper surface and by so doing blasts a jet of smooth air towards the trailing edge of the flap. The Fowler flap really is an adaptation of the famous Handley Page slotted flap; in both cases the flap, as well as "heaping up" the air under the wing, also allows it to slip through the slot and help maintain the smooth flow and high suction over the upper surface.

This flap has an inherent tendency to retract. Instead of being held in its outward position by the beating of the wind in flight the aerodynamic forces on it are such that they always tend to nose it forward in the direction of flight. In other words, the resulting chordwise drag, which normally acts aft, on the Fowler acts forward. This peculiarity arises from the pressure drop in the airstream due to it being speeded up as it passes through the slot. As a result the nose of the flap is in a zone of high suction which overcomes all skin friction drag and tends to suck the whole flap forward.

Fowler flapped wing lift coefficients brand it as one of our best known lifting mediums. With the flap out and deflected 30 degrees down, recent NACA tests show lift coefficients varying from 2.3 for the 20 per cent chord Fowler, to 2.9 for the 40 per cent Fowler. This means the flapped wing can lift approximately 55 to 95 per cent more than a modern wing section by itself. In addition this lift is created with less drag than a similar wing equipped with the well-known split trailing edge flap. Further boosts in lift and drag can be obtained by allowing a greater downward movement of the flap.

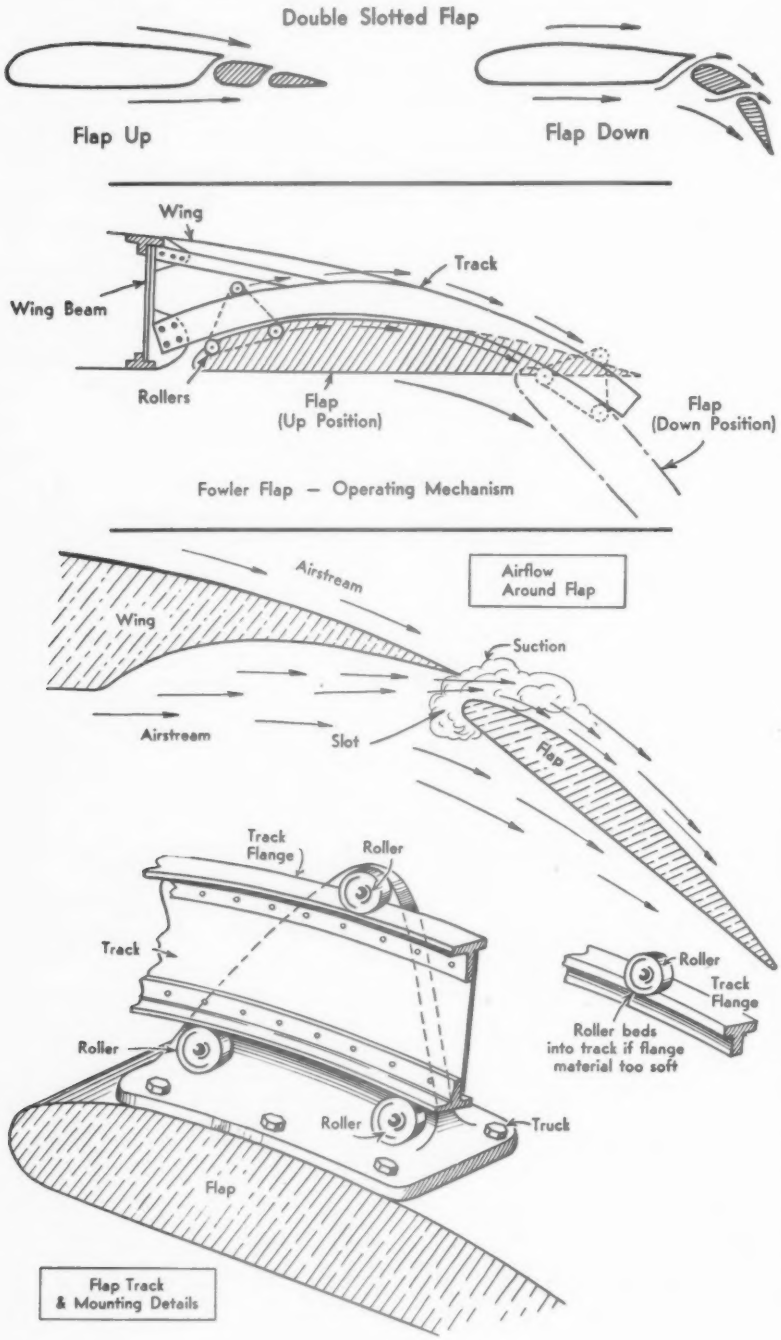
These flaps' adoption was delayed by certain disadvantages not easily hurdled. To begin with, a larger and heavier horizontal tail is required to compensate for tail efficiency loss when the flap is out. Add to this the long, overhanging flap tracks' weight, some of the profits gained from the extra lift are negated.

Apart from being aerodynamically unsightly, moreover, these flap tracks, with their surrounding parts, are a structural headache. Since any wing's rearward portion is relatively thin, it is difficult to maintain a rigid trailing edge after a gaping pocket has been cut out of it to house the retracted flap. Through this skimmed down section—and probably dependent on it for lateral support—must pass the flap tracks themselves on their way to a firm anchorage on a reinforced wing beam. The flap rollers must be carefully fitted to the tracks so no fatiguing chatter can build up while the ship is warming up on the ground. In flight the air pressure on the flap will hold the rollers relatively snug on the track flanges, of course.

Fowler flaps usually are fixed to a group of needle bearings which are small, strong and capable of withstanding the heavy, concentrated loads heaped on them while the ship is in flight. Any tendency for these bearings to bed into the track must be eliminated. Although tracks usually are made from aluminum alloy extrusions, this bedding may necessitate heavy, heat-treated steel tracks. Holding the track flanges to the fine tolerance required for smooth bearing operation takes extreme care. Therefore it is generally impractical to construct built up tracks of aluminum alloy sheet, it being very difficult to keep them within the accurate clearances necessary.

Rigidity of the flap and its surrounding and supporting structure is the design keynote, since the Fowler is aerodynamically sensitive to any variation between it and the wing's trailing edge. To increase or decrease this critical clearance—due to excessive deflections—from the flap's static position at approximately 2½ per cent of the wing chord below the wing's rear edge, will cause a loss of lift.

(*Continued on page* 88)



Supply Center

THE Army Air Corps has at Wright Field a battery of new card punching machines, the first of their kind in the world, to perform the tremendous task of keeping daily balances on all equipment in the Air Corps supply depots operating throughout the United States.

Automatically operating from teletype tape, the new machines swiftly and unerringly do a job which would be physically impossible under the old hand filing system. They keep tab on all the Air Corps stocks of airplane engines, propeller assemblies, airplane tires, fuel pumps, landing gear struts and the thousands of items and parts which constitute the Army's aviation equipment.

Operated in conjunction with the new machines is a far-flung network of teletype machines, linking Air Corps supply depots and tactical bases of the nation with headquarters at Wright Field. Through this system the Army now gets a daily balance on all its equipment, hot off the teletypes, which report 40,000 changes a day in balances on individual items of equipment at individual bases. Girl operators at the teletype message center daily receive reports from the Army's six air depots scattered over the continental United States and reports from the 52 Air Corps stations which these depots service. The workers are on duty in two shifts from 6:20 a.m. until 8 p.m. As the Air Corps expansion program progresses the system will be held open longer and ultimately will be placed on a 24-hour-a-day basis.

Each operator handles incoming and outgoing messages for one depot and the air bases which it services. Facilities have been completed for communication with new depots at Mobile, Ala. and Ogden, Utah. Eventually 11 depots will be serviced.

The biggest advantage of the new system is that the balances are received on teletype tape, which is fed through the newly devised card punching machine. This machine records automatically each new balance on a card which is then filed automatically.

Thus, the new plan makes it possible to correct the record of a depot's store of any one of 300,000 articles stocked as soon as the balance is changed by shipment through the depot.

Prior to the establishment of the new setup, the Air Corps kept check on its stock by a system of machine posting in duplicate of stock record cards at stations and depots. Once a year the duplicates were sent to Wright Field where they were transcribed to tabulating cards, which in turn were used for preparing reports from which supervisors would purchase and distribute new stock.

With the new system, the Wright Field budget office receives daily the closing balances on hand of all items in which any change has been made during the day, at each of the several depots. From the automatically recorded tabulating cards, a report is available each day to the supervisors.

FROM HEADQUARTERS

by Lieut. Col. HAROLD E. HARTNEY (A. F. Res.)

Harold E. Hartney

FROM a disunited half-hearted hodge-podge of factions, the warplanes of the Nipponese have overnight brought a metamorphosis that will go down in history as one of the great moments in civilization's progress.

How different life in Washington is today from what it was just before bombs fell on Pearl Harbor.

No more strikes. Only one or two silly political chatterers camouflaging their drivel under the suger-coating pretext of patriotism. No more rackets. No more boondoggling. Intrigue and vanity "out the window." In a matter of hours, the long-looked-for jolt has come like a bolt from the blue. The country is united. The Quislings have slunk away. We are united and facing cold hard facts and the greatest of these is the power of the Air.

There is no time here for saying "I told you so." It is beside the point to upbraid ourselves for not having had more courage in our convictions. We do not have time to give thanks that no longer will we be called insincere and crazy flyers and job-seekers when we venture our opinion.

Our backs here in Washington are "against the wall" and now the good in those at Headquarters and those in the field will at last come out.

But it makes no difference now. The democracies are lined up squarely against the totalitarians. One or the other will win. If it be the former, there will be hope and in due course prosperity and happiness. If the latter, from Fort Knox to the Potsdam will go our gold and even our dollar will be worthless, freedom and liberty will vanish from the world; instead of three-car families it will be one car for every third. Aviation in the hands of international tyrants will hold in check the forces of corruption, greed and selfishness over the whole globe, but according to the standards of a tyrant.

Shakespeare said that man could ever "Smile and smile and be a villain!" He was right.

Even as the smiling, cringing Nippons were talking peace with our own sincere statesmen, their bomb- and torpedo-loaded air carriers were closing in on Pearl Harbor, their subs and cruisers steaming to our keys to the Pacific.

As one looks back at the events of the last few weeks there are many interesting sidelights.

Consider the radio forums wherein was debated the power of the air. Where are those statesmen and defense experts now who ridiculed the power of the air or the victories of the RAF? Since writing last for this column many interesting airmen have been in Washington. Recently came a flyer known from coast-to-coast, to join the Army Air Forces. He brought his trophy room fixtures with him. Therein was an autographed photograph of one of our best known stunt flyers who had become the idol of our people. In the box of trinkets was a German Iron Cross given him personally by Udet. Said the flyer's wife to him, "I won't let you hang that picture and I'm going to throw that German medal in the Potomac." They compromised, hung the famous flyer's picture upside down and pinned the iron cross above it.

Another interesting flyer of world war days, shortly before Japan jumped us, came down here to debate as the colleague of another famous flyer the subject, "shall we break off diplomatic relations with the Vichy government?"

Bearded to cover a world war wound, he was very picturesque. He and his partner were up against one of our most eloquent statesmen and his colleague, a leading newspaper columnist. To say that they made monkeys out of their opponents would be putting it mildly. It made one feel that, after all, flyers could talk as well as fly. They put up so good a case for poor France that they were invited over to its Embassy where they were actually embraced, kissed on both cheeks and treated to the last two quarts of "Moet et Chandon" in the cellar.

The war is not very old yet but already Frank Luke's record is broken,—at least in theory. Sam Moore, now a Major in the Air Corps, of "Happy Haven" fame to you QB's, Early Birdmen and Aviation Legionnaires who read this column, came in and reported that his son joined up recently and, in maneuvers, with three wooden guns, his battery shot down 32 airplanes in one day,—got Luke beaten a mile.

Major John Huffer reporting here in Washington for his appointment in the Specialists Reserve Air Corps this month told some most interesting stories of his experiences in France before and during the recent capitulation.

Huffer commanded Rickenbacker's 94th Aero Squadron before "Rick," having served in the last war with the French before joining up with us.

Anxious to renew his commission in the French Aviation Service just after Hitler invaded Poland in 1939, he was not permitted to see even his old buddies, now Colonels and Generals. He purchased a French officer's uniform, hailed a staff car and proceeded to his old commanding officer's headquarters several miles outside Paris. Saluting and in his best diction he greeted him saying "reporting for duty, sir."

Being congratulated on his joining up so promptly, Huffer hurried to explain, "As a matter of fact, that's what I am here to discuss with you." He was back in service again within 30 days or he

(*Continued on page* 114)

This new RAF Avro "Manchester" is one of largest twin-engined bombers in the world. It carries crew of seven.

HAVE YOU SEEN?

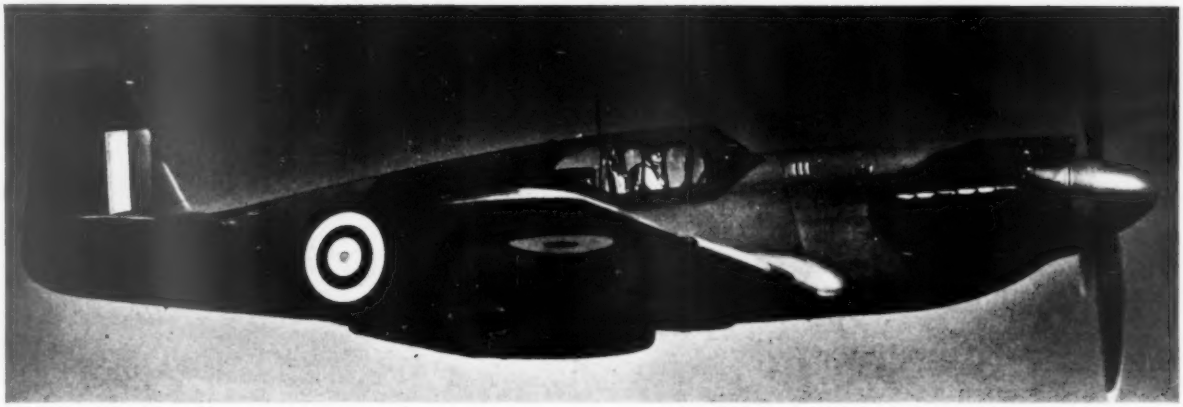
CHARLESTON S C
LAT 32 54 N LONG 80 02 W
VAR 1 W ALT 40 FT
SAVANNAH GA. 227 T. 88 MI.
JACKSONVILLE FLA. 201 MI.
ORLANDO FLA. 331 MI.
TAMPA FLA. 379 MI.
MIAMI FLA. 527 MI.

Hawthorne Flying Service, Charleston, S. C. designed this unique milepost to give wandering pilots much-needed data.

Portable landing mats, made of 50-pound steel planks clipped together, make possible quick setting-up of advanced landing fields. Here workers lay "field" at Arston, N. C.

The war's No. 1 ace, Sgt. Gareth Nowell of RAF, and wife. He holds DFC with bar. In one week he shot down 12 enemy ships.

Bell "Airacobras" with RAF squadron in England. British have installed rapid-fire .20 mm. cannon in nose, .30 and .50 caliber machine guns in ship's wings.



North American's new "Mustang" fighter now going to RAF. The ship is all-metal, monocoque construction powered with 1,150 h.p. Allison. U. S. Army Air Forces' pursuit version is designated P-51.

Detachable wing tips, no floorboards and 30-gallon gas capacity are outstanding features of this new Howard trainer, Warner powered, it will cruise at 90 m.p.h.

Army officers inspect Eastman rare-element light-bending lens made without silicates.

Inside the control cabin of the Army's 82-ton Douglas B-19. Seat arrangements allow for seven including flight commander.

Col. M. G. Estabrook, commanding officer, salutes group of women flyers who ferried lightplanes to Patterson Field.

Artist's drawing of 12-place amphibious glider being ordered for the Navy. Ships will be nearly the size of DC-3 airliner.

Depleted Italian air force now uses old German Junkers Ju-87 "Stukas." This one was captured by British in Libyan desert.

I LEARNED ABOUT FLYING FROM THAT!—NO. 32

by EVELYN N. BURLESON

Fog over the Cascades nearly spelled death for this aviatrix, who didn't trust her instruments.

WHEN you hear a pilot friend discuss an unusual flying experience or difficult situation that stands out in his memory, you are interested and entertained for the time being. But soon his story is crowded from your mind by newer subjects. You forget it. While the incident may have been the highlight of your friend's flying career, it's just another story to you. That is the case with all of us. How many times have you heard this or that pilot tell of being lost in a fog or snowstorm, of making a forced landing in a difficult place or of bailing out? Quite often, no doubt. Somehow, those things don't seem to apply to yourself, until they happen to you. Then those stories come back with a rush and you begin comparing notes. You find that the other pilots' reactions to a situation were the same as your own. That happened to me. I have since compared the experience of which I am writing, with those of pilots who have been in a similar predicament and learned that their's differed only slightly from mine. One of these pilots is Richard M. Depew, vice-president of the Taylorcraft Aviation Corp., who was fog-bound over the Alleghanies back in 1929, but who was not so fortunate as myself in getting out of it. He joined the Caterpillar Club when an aileron gave way in a dive. However, up to the moment that he jumped, Mr. Depew says that he met with the same problems that I did, in my adventure.

I got into a fog, at night, over the Siskiyou Mountains with a heavily-loaded airplane, with no blind flying instruments and no radio. Luckily, I'm still here to tell the story and so is the airplane. Thereby hangs the tale.

On October 1, 1941, I took off from Sea Island Airport in Vancouver, British Columbia, in my Lycoming powered Taylorcraft *Miss Liberty*, on a non-stop good will flight to Tia Juana, Mexico, landing there on the morning of October 2nd.

The author in her Taylorcraft "Miss Liberty" which was specially fitted with extra tanks for the non-stop flight from Vancouver, British Columbia, to Tia Juana, Mexico.

The take-off had been delayed a day, due to bad weather in various places along the proposed route. I was anxious to start. October 1st dawned bright and clear in Vancouver. The weather reports looked favorable all the way, with the exception of scattered showers over the Cascades and Siskiyous. I thought it over. To go or not to go? The weather man wouldn't advise me either way. I couldn't blame him. After all, why should he assume the responsibility of sending someone on such a long trip, on a word from him? He did say though, that a front had just passed and another was on the way, which would possibly reach Vancouver in a day or two. If I were to leave that day, I would miss both of them. As for the scattered showers, it was yet early in the day. By night, when I would be over the mountains, the condition could be changed considerably. At night the temperatures would be more uniform and there was a possibility that the showers would be cleared out by then. The weather man's attitude indicated that he would have preferred me to stay over to wait for better weather, no matter how long the delay. Regardless, I decided to go. I reasoned that you can't hand-pick your weather in the fall of the year, especially near the coast and that I had best take advantage of the weather that day.

The departure was at 2:30 in the afternoon. *Miss Liberty* got off in an easy 1,000 foot run, despite her 315 pounds overload of 80 gallons of gasoline, extra tanks, extra oil, incidentals, parachute and pilot. By the time I reached Blaine, Wash., about 25 miles out of Vancouver, she had climbed 2,000 feet.

There was a high overcast in Washington, which extended to southern Oregon. The visibility was good. It was grand, flying along and watching Bellingham, Everett, Seattle, Tacoma and Kelso, Wash., pass under me. Then a half hour's flight down the beautiful Columbia River to Portland, Ore. There, it was nearly sundown. By the time I reached Albany, Ore., it was pitch dark and I could see several beacons ahead. Near Eugene, there were large breaks in the overcast and the moon shone through.

The trip over the Cascades was uneventful except for a large cloud bank which lay near Roseburg. By the light of the moon, I could see that it was only local, so I flew around it. At Grants Pass, the overcast had disappeared and it was clear all the way to Medford. "Well," I thought, "this looks like clear sailing from now on. I think the worst is over." But, I was mistaken. If I could have foreseen what was ahead, I would have opened the dump valve to dispose of the gas load and landed at Medford.

South of Medford, in the vicinity of Ashland, I encountered another overcast. I was flying at 8,000 feet by that time, to clear the 5,000 and 6,000 foot Siskiyous which start immediately south of Ashland. The overcast appeared to be about 1,000 feet above me and as far as I could ascertain, there was nothing ragged on the bottom. So, feeling somewhat uneasy with this turn of events, I shoved in under it. It was black as the ace of spades under there and all I had to go by were the lights on the ground. Ashland passed behind and I could see the first and second beacons to the south. By that, I judged that the visibility was at least 10 miles and there didn't seem to be anything to worry about. I looked back for my final sight of the lights of Ashland. One beacon was below me and the other ahead. I glanced forward and began watching for a third beacon. Just then, the farthest beacon disappeared. I sat there, staring at the place where I had last seen it, waiting for it to reappear. I thought: "Either there's a high hill between that beacon and me, or there are some low-hanging clouds. The latter is probably the answer." I made up my mind to turn back, but, a moment too late. Suddenly, I realized that the beacon below me and Ashland had disap-

(*Continued on page 82*)

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PIPER OUTSELLS ALL OTHER LIGHT PLANES COMBINED

La Guardia's Beehive

(*Continued from page* 19)

are a dead loss to the communities which built and maintain them. It has a bank on the premises which claims the distinction of being "the world's first airport bank." It has display windows for a furrier, a leather goods dealer, a cosmetic distributor, it has sales counters for a jeweler and a model plane manufacturer, it has a stock broker's office, where one may get the latest quotations of the New York Stock Exchange; a filling station, a paying spectators' platform —which, incidentally, is the largest single source of income except for the airlines —it has rental parking lots and it charges limousine passengers and taxicabs 10c each for the privilege of using the port. Where most airports grant space to the U.S. Post Office, rent free, La Guardia Field collects $2 per square foot for postal facilities. On other fields, the Department of Commerce weather bureau is a welcome guest, but at La Guardia Field it pays part of the upkeep.

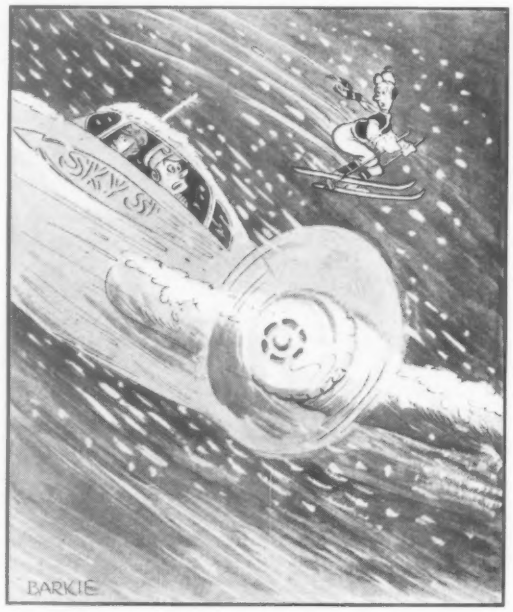
Even the control tower operators are paid by the airlines, who not only rent their office and hangar space, but donate a royalty to the city on every gallon of gasoline loaded there. The city collects rent from the Civil Aeronautics Board, from Casey Jones, from the Hotel New Yorker—which also pays a percentage of its gross revenue for exclusive restaurant rights—and from the barber shop. There are landing fees applied against private operators and the airlines. To top it all, the city has persuaded almost all its customers to bear so great a percentage of the operating cost that this huge enterprise costs it only $125,000 per year for upkeep.

In spite of the charges for spectator parking and admission to the promenade, sightseers throng the airport on every pleasant weekend day. La Guardia Field has become a greater all-year attraction than the Statue of Liberty and it rates almost as many mentions in the Broadway columns as any single night club. Smart society makes a rendezvous of the Terrace Restaurant and of the Kitty Hawk bar, where prices are higher than in most New York dine and dance spots, but where the floor show put on by the airlines every day and night surpasses the best in night club entertainment. The Hotel New Yorker operates both these rooms, as well as the coffee shop, a snack bar, the newsstand and a catering service to most of the airlines.

The dime apiece that spectators pay for the privilege of hanging over the upper deck of the ramp to gawk at passengers is well repaid in the celebrities they see. Movie stars, radio performers and the Roosevelt family keep the crowds satisfied. Many children spend hours watching the *Stratoliners*, the DC-3's and the sleeper planes as they taxi in to the ramp, load and leave.

Multiplication of flights has brought up many problems for the control tower and Airways Traffic Control, especially during periods of instrument weather. Until last winter, it was the practice of ATC to "stack up" planes over the airport during bad weather, clearing them in one by one on an average of 15 minutes apiece. At one time, 22 planes were flying over the airport and its environs, waiting their turns to land.

Recently the airlines, working in conjunction with Governmental agencies, have improved manyfold on this problem. It had become so serious that pilots complained to the Air Line Pilots' Association that, during three months of the previous spring, 750 hours had been lost circling the La Guardia airport waiting to land.



"I don't care what that altimeter says, we'd better climb."

This meant many missed passenger and mail connections, caused ill will toward the airlines, contributed to pilot fatigue and harassed the passengers. Sometimes flights were delayed above the airport as long as two hours waiting their turns to land. So the airlines, together with Airways Traffic Control, worked out a system of instrument landing called "range control." By this system, ATC and the control tower operators communicate directly with the airplanes holding for landings, instead of issuing orders to the airline dispatchers, who had to relay the information to their own planes.

It works this way: any plane approaching La Guardia Field during instrument weather comes under the jurisdiction of range control when he is cleared to the Coney Island range intersection at 4,000 feet. All planes are separated in altitude by 1,000 feet and are all tuned in to the one radio transmitter, thus knowing what all other planes in the range control area are doing. When the lowest plane is cleared to the control tower, he reports leaving Coney Island and again when he sights the field. Then each plane is cleared down 1,000 feet and the lowest proceeds to the field.

Provision is made for radio failures and missed approaches. Further to avoid stacking up, the airlines frequently clear flights which might experience long traffic delays at New York to their alternate airports, where passengers and cargo are trained. The range control procedure cuts instrument approach time to approximately four minutes and is conceded by pilots to be the closest procedure yet to the ultimate in traffic control during inclement weather.

The control tower, which polices traffic within three miles of the airport, has done some remarkable work in speeding up arrivals and departures during contact flight weather. There is a tendency on the part of the airlines, like other transportation systems, to bunch their departures around certain hours. Thus we find that in the early morning, around noon, early evening and late evening hours, there is a concentration of arrival and departures on all lines, while the traffic is sporadic during other periods of the day.

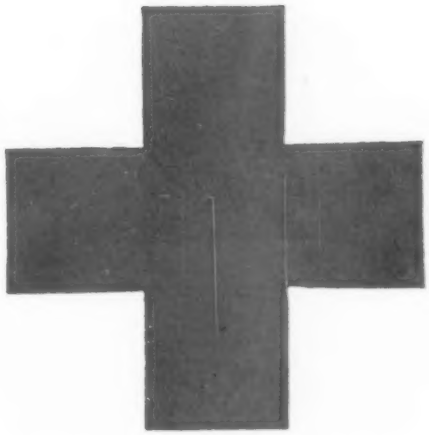
To the control tower this presents numerous obstacles because, obviously, if four flights are scheduled to depart at noon, three of them must be late every day—unless they can clear all four within a minute. The tower solves this problem to the best of its ability by scheduling its personnel so that at least two and sometimes three men work during peak periods, while only one man directs traffic at other times. Their record was the dispatching of planes only 40 seconds apart (in CAVU weather) continually for one hour and two minutes!

On December 9, 1940, six planes were dispatched at 30-second intervals during the noon rush. This was not an attempt to make a record, but simply efficient handling of a difficult traffic problem. Largest single day for the tower was the Friday before Labor Day this year, when they handled 425 arrivals and departures in a 24-hour period. The average daily traffic is 270 flights, of which approximately 15 are itinerant civilian or military craft.

Although North Beach (as La Guardia Field used to be known) has been in operation for two years, it still is being built up. Completed last spring was a seventh gigantic hangar to house Eastern

THE RED CROSS

needs the financial aid of every American.



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Air Lines and Canadian Colonial Airways. A $500,000 hangar is being constructed for use by American Export Airlines in the same area as the 60 x 100 feet hangar for itinerant planes and the CAA office building and hangar, both of which were completed last winter.

Since the airport opened the Academy of Aeronautics building, a school for mechanics; and barracks for Army student mechanics have been raised. Now under construction is the $7,200,000 connecting highway, a road with five bridges and one tunnel, which will connect the airport directly with the Queens Midtown tunnel and bring La Guardia Field within 15 to 20 minutes of midtown Manhattan. This includes a bridge over the Grand Central Parkway on the east end of the airport, to give motorists outlets at both ends of the port.

A typical Sunday sees 150,000 to 200,000 visitors at the airport, a tenth of whom will pay 10c apiece to see the show. Police report that such an average crowd will arrive in 25,000 automobiles, causing a traffic jam within the grounds comparable to the rush hour crush down town. Ordinarily 27 patrolmen, three motorcycle policemen, a detective and two sergeants can handle the mobs, but they are reinforced on Sundays with six extra mounted police.

What can be done when the airlines take delivery on the planes promised them by the Government is problematical. Unquestionably additional flights will be scheduled when delivery is taken and, if space demands continue as high as at present, the airlines will have no trouble filling them. Can La Guardia Field handle more traffic?

Yes and no. Unless the airlines will accept less favorable departure and arrival times to favor the traffic congestion, they cannot continue to increase their New York business. If they space out their trips during the slack hours, the traffic can be handled easily. One outlet is New York's co-terminal, Newark, where traffic now is light. Mayor La Guardia had been booming Floyd Bennett Field as a third terminal, but the Navy's acquisition of that port eliminates it as a commercial enterprise.

La Guardia now is working on the Board of Estimate to purchase or lease a plot in Queens twice the size of North Beach as another New York municipal airport. Now that he has survived the November election—and if he uses the same persistence with which he forced North Beach into existence—the airlines may presently have a second airport in the city.

The mayor himself, who must be given credit for the building of the airport named for him, takes a jealous pride in his field. He is concerned with the price of meals in the coffee shop as much as he is with the profits and losses. One morning, when an airliner landed with its wheels retracted, the Little Flower rushed to the scene and refused to let reporters or spectators approach the plane. So anxious was he to guard the reputation of his airport that he refused the airline's own publicity chief access to the scene.

He hacked the first piece from the 320-pound birthday cake displayed in the main rotunda on the first anniversary of the port's opening and pointed out that the traffic had increased the first year to an average of 3,000 passengers a day and from 238 to 250 flights.

There never has been a serious accident at La Guardia Field, although several small fires and minor collisions of planes with trucks have been reported. One day in August, 1940, everybody was thrown into confusion by a loud blast of fire whistles and the clanging of fire alarms. Four fire engines, three radio cars, a crash wagon and the field's fire

"Wow! To think that we almost didn't crash!"

equipment arrived quickly. But the alarms first showed one hangar, then another, then the administration building on fire. Then the sea base signal pealed, then all repeated themselves. Everybody heaved a big sigh when the fire marshal found a short circuit in the alarm system.

Because spectators have interfered with normal operations at the airport and have usurped the small lounge for passengers, a waiting room for their use only will be built on the lower rotunda at a cost to the city of $14,921.

Commissioner of Docks John McKenzie announced as long ago as last January that floor space in the administration building would be increased by 7,200 to 14,400 square feet by the addition of three stories flanking the central rotunda overlooking the field. These rooms would be 20 to 40 feet wide and 60 feet long, but no further action has been taken on this.

McKenzie's plan was the outgrowth of abnormal demand for space for display purposes and office space. The rental rates have soared from $2 per square foot in the administration building up to $100. Space has grown so valuable that a cargo cart runway built in a semi-circle around the field side of the building has been converted into offices, and the space formerly used by newspaper reporters has been rented to American Airlines as a station manager's office at $5 per square foot.

Four display windows, a tiny space for Cartiers' sales counter and a cubby hole in a passageway off the rotunda, used by the brokerage firm, alone are bringing the city $6,000 per year. The Empire Trust Company is variously reported as occupying 715 and 750 square feet and paying $2,040 or $3,300 yearly rent. A small gasoline station is installed directly in front of the administration building. It is allowed to sell gasoline—but not oil—and forbidden to do any repair work. It pays the city a royalty on every gallon of gas sold. Two other locations will be let to private concerns on the airport for service stations on the same basis.

Reports of the sinkage of the buildings have been somewhat exaggerated. City engineers allowed for some settling and a fund was set aside to handle repairs necessitated by sinking in the soft fill. Twenty-six hydraulic jacks support the front of the administration building pending permanent repairs. Many walls have been cracked because of uneven settling, but this is considered unimportant, since the building is not structurally affected.

Most sumptuous rooms on the airport are the two used by American Airlines to entertain members of the "Admirals Club of the Flagship Fleet." Here there is a lounge floored with thick carpeting and tastefully furnished with overstuffed chairs and sofas. It connects with an austere conference room at one end and a bar at the other. These rooms were originally built as the mayor's office, but he sacrificed them for $2 per square foot. Bar receipts help American defray this passenger service expense.

American Airlines is the largest operator on the field, normally scheduling more than twice as many flights as its nearest competitor, Eastern Air Lines. American operates 59 round trips on weekdays, Eastern, 23; TWA, 20; United Air Lines, 15; Canadian Colonial, five; Trans-Canada, three.

Only American has its reservation office on the field. For it they built an addition to one of their three hangars. It is the largest airline reservations office in the United States, equipped to handle 80 telephone calls simultaneously. An average of 5,000 to 8,000 calls is handled daily, the greatest number coming on Wednesday.

A mile of endless belts eliminates office boys. The Friday before Labor Day of last year, American originated 1,628 passengers at New York—nearly as

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many as all the other airlines combined.

Biggest thrills to sightseers are the arrivals and departures of the transatlantic Clippers. On days when a Clipper is scheduled to operate into or out of the marine base, cars throng the surrounding streets and hundreds of persons crowd into the Pan American waiting rooms. Most talked of event last winter was the arrival one day of four Clippers within 49 minutes. Ground swells in the waters off the Azores had delayed three trips from Lisbon, and the fourth was a Bermuda-Baltimore flight which came into New York carrying mail delayed in Bermuda by the British censors.

The economic impact on Queens of La Guardia Field has been marked. During July, 4,218 persons worked at the port, most of whom live nearby in furnished rooms, apartments and houses. The annual payroll is approximately $8,500,000, the great majority of which is spent locally. The Chamber of Commerce is attempting to build, with private capital, an aviation trade center directly across Grand Central Parkway from the field. They would have recreation space, stores, garages, educational displays and carry out an aeronautical motif as a lure to the community of aviation workers who are noted for their interest in and loyalty to their work.

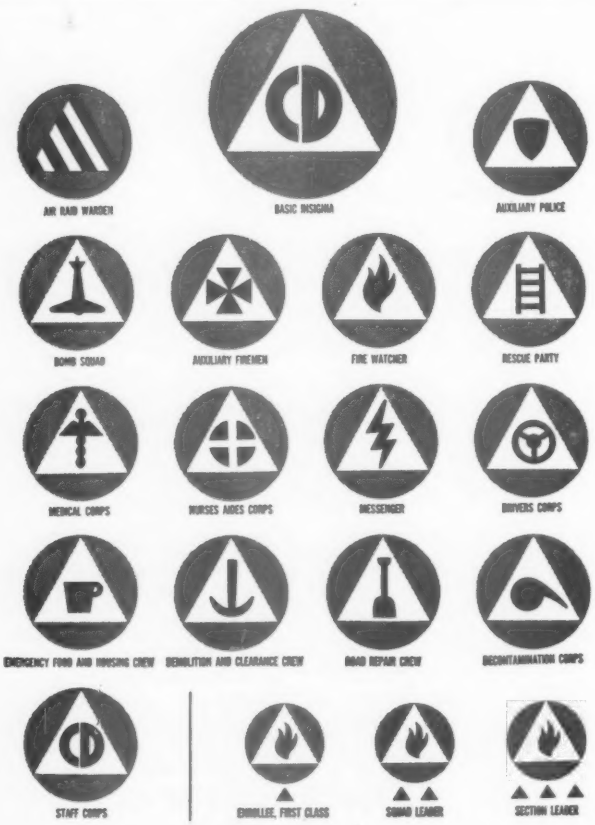
It's a strange and exciting place, this La Guardia Field, with everybody going some place or doing something interesting. There was the odd adventure of a Mrs. Smith, who was trying to get from Boston to Washington. Her flight was delayed by weather in Boston, so she hopped into a taxicab and called to the driver: "Take me to La Guardia Field, New York."

Arrived at the New York field, she found the New York plane to Washington also delayed, so she jumped into the same taxicab, declaring her intention to take it right to her destination—if the Pennsylvania Railroad was delayed.

And there was the Pan American employe who entered the administration building one morning to find a husband and wife asleep in two of the model berths on display in the lobby. They had been to see the World's Fair, but couldn't find hotel accommodations. They had really intended to sit up in the waiting room all night—but sleep got the better of them.

It's all part of life at La Guardia Field.

END



CIVILIAN DEFENSE BADGES

SOON to go into action will be thousands of volunteer civilian defense workers, each of them wearing one of the badges above. All will be unpaid volunteers who will learn and carry out their particular jobs in their spare time. At the moment, such volunteers are being recruited by the American Legion. It is expected that the Army, working directly with the Office of Civilian Defense, will have direct charge of the whole setup in its finished and operating form.

I Learned About . . .

(*Continued from page 76*)

peared, too. I turned on the cabin light. Fog was all around the windows. I was right in the soup.

My only thought was to get back out of it, back to Medford. It was an eerie, all-alone feeling. I was totally unfamiliar with blind flying and almost as totally unprepared for it, with what instruments I had. Friends who had felt concern for me on this flight had warned me to turn back at the first sign of bad weather and I had promised faithfully that I would. Now here I was, right in the thick of it. I had flown into it, without knowing it was there. The lighted airport at Medford would have looked like Heaven just then!

My first reaction was not one of panic, but an urge to remedy the situation in a hurry. That's where I made my first mistake. I acted too hastily. Perhaps I was mentally fatigued by the seven or eight hours of flying I had already put in that day. Perhaps it was just plain ignorance. At any rate, I acted before I thought. If I had taken into consideration the rarity of the air at 8,000 feet and the effect a steep bank would have on an overloaded airplane at this altitude, I might successfully have made a gentle 180° turn. There is a chance, although a slim one, that I would have come out headed north. But, in my anxiety to turn back I banked too steep. I may have applied too much rudder. Perhaps, in my mentally sluggish state, I couldn't tell the difference between a good turn and a bad one. This turn seemed all right and I didn't know that anything was wrong until I noticed the motor was racing. I felt the airspeed pick up and saw the compass whirl round and round, rapidly. This was a complete surprise and for a second it didn't seem possible. "This must be a spiral or a spin," I said to myself and throttled back the motor. Then I decided that it was a spiral and that the ship would be spiralling in the direction that I had turned. In trying to recover from the spiral, I only made matters worse. The compass was still whirling and the airspeed indicator was showing an alarming rate of speed. I decided on a spin recovery. There was no time to lose. I neutralized the controls and waited for about a second. Then, I pulled back on the wheel. I could feel the ship respond and I knew instinctively that I had done the right thing. Soon, the motor was running normally once more and the airspeed stayed at 80. I glanced at the altimeter. My hair almost stood on end when I saw that it read only 5,000 feet! How quickly I had lost 3,000 feet of altitude.

The surrounding hills were shown on the map to be 5,000 and 6,000 feet high. I expected any moment to fly into a mountain. The fog was still all around the windows. I learned later that I was

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approximately over a valley which was at 3,000 or 4,000 feet. A couple of guardian angels must have been working overtime that night.

Then, it occurred to me to bail out. But I figured that my best chance was in staying with the ship, that I was probably too low to jump anyway. Perhaps I would step right out into a tree. It was a 50-50 proposition.

With the airspeed staying at 80, the ship should have felt normal, but it didn't. I was positive that it was diving, so I pulled back on the wheel and watched the airspeed indicator drop toward the stalling speed. While the airspeed indicator showed a loss of speed, the nose of the ship seemed to be going down and down. Then for a moment, I'd believe the airspeed indicator and let the wheel forward.

On information from other pilots and from books, I had learned that your sensations will fool you when you are flying blind. Truer words were never spoken. My feelings really got the best of me. I imagined that the airspeed indicator had gone haywire in the spiral, else how could a ship feel so different?

I did a series of these climbs and dives before I came to my senses. In a flash I remembered something: "When in doubt, let the ship fly itself." This I did, and the airspeed came back to 80 and stayed there. Then I set the stabilizer back until the airspeed read 70 and let the ship climb. The main thing was to get higher than the mountain tops. That was my only chance. Slowly, it seemed a long time, the ship climbed to 7,000 feet. What a relief! In the meantime I was trying to keep the ship level laterally and to keep headed north to Medford and safety.

There was a bank indicator in the ship, thank goodness. Without it, I'd have been sunk. The compass slowly went round and round, north, east, south and west. Then back the other way, north, west, south and east. I knew the ship was in a gentle turn, first in one direction, then the other, and I was trying very hard to keep the ball in the center of the bank indicator, but somehow, I couldn't. It was maddening. You become angry with yourself at a time like that. You are failing the ship, you are failing yourself. You blame only yourself.

Finally, it dawned on me that I was trying *too* hard to keep the wings level. I was fighting it. "Take it easy" I said to myself, "Keep your head." Figuring that there must be some way to keep the wings level and the ship headed in one direction, I hit on a solution. A simple thing. I pointed the flashlight down on my feet and made certain that the rudder pedals were exactly in neutral. I held them there firmly. Then, using only the ailerons, I kept the ball quite satisfactorily in the center of the bank indicator. It was fairly easy. After a fashion, I even managed to head the ship north. Frequently the ball would roll off center to left or right and the compass would veer slightly to west or east. The only help I was giving the ship was in trying to keep the wings level.

I flew this way for a long time. It seemed hours. It may have been only a few minutes. I became impatient, thinking that I should have come out of it before this, never considering that I was bucking a north wind. The north wind must have drifted the ship south a ways and in heading north there was also a reduced ground speed. I evidently didn't allow enough time.

Feeling that I was getting nowhere fast, I decided to head south instead, that there was as much chance in that direction as there was in heading north. Very carefully and fearful of getting into another spiral, I made a gentle turn and was able to bring her out headed south, with no further difficulties. The oscillation of the lightplane compass was something to cope with and I got my best results by making every move very slowly.

Miss Liberty continued to climb, steadily. My next worry was Mt. Shasta which stands up more than 14,000 feet and which was only a little east of the course. Now and then I altered my course slightly to the west. Better to be off course, than to hit a mountain!

I thought of a lot of things as I sat there climbing in the fog or clouds. I thought of the 99's and the Associated Women Pilots in Seattle who had so confidently given me a lovely send-off dinner. I thought of the swell people up in Canada who had graciously put forth their best to entertain a neighbor from the United States. I thought of Roy Hubert of the Hubert and Dillon Air Service in Tacoma, Wash., who had spent evening after evening preparing *Miss Liberty* for this flight. I thought of my mother and was glad that she didn't know where I was at the moment. Mostly I mentally kicked myself for being a nitwit.

Finally, at around 8,000 feet, I had my first indication that I was coming out of the stuff. I saw a tiny, round, white thing about the size of a pea. It was the moon, shining in through the fog. It became bigger and bigger and soon I popped out of the fog into the clear moonlight. Approximately five miles ahead and five miles to the left, was majestic Mt. Shasta. Never have I seen a more welcome sight. A little farther on, I picked up the beacons once more. I had come out nearly on course.

At Redding, Cal., where the Siskiyous end, I came down to 2,000 feet and followed the beacons, mile after mile, through the Sacramento Valley, the San Joaquin Valley, over Fresno, Bakersfield, the Tehachepi Mountains and Los Angeles. I landed in Tia Juana, Mexico, at 7 a.m. just 16½ hours out of Vancouver.

On the return trip I had *Miss Liberty* checked at San Diego for possible damage resulting from the strain of pulling out of the spiral. They didn't find a thing wrong with her.

In looking back over this flight, I try to analyze it: Would anyone else have bailed out during the spiral, instead of trying to right the ship? Would anyone else have gone under this overcast the way I did, not knowing what was under there, instead of turning back to Medford at the first sight of it? Someone with more experience can answer these questions.

After an episode of this kind, one realizes how easily a pilot inexperienced in blind flying can get into trouble and how quickly a fatal accident would result. Those instrument ratings of yours are nothing to be sneezed at, they're precious.

Suppose I had had less altitude when I started over the Siskiyous; suppose I hadn't been able to recover the ship from her spiral, in time; suppose I hadn't been over a valley.

I'd be pushing up daisies right now and a possible fruitless search might have been made for one more missing airplane. Another unexplained accident might be chalked up in the records.

There's no use kidding myself. Lady Luck was riding with me that night. Believe you me, that won't happen to this gal again. Once bitten, twice shy.

At least I learned a valuable lesson: That it is better to do nothing at all, than to do the wrong thing. That time-worn bit of advice applies once more: "Think before you act."

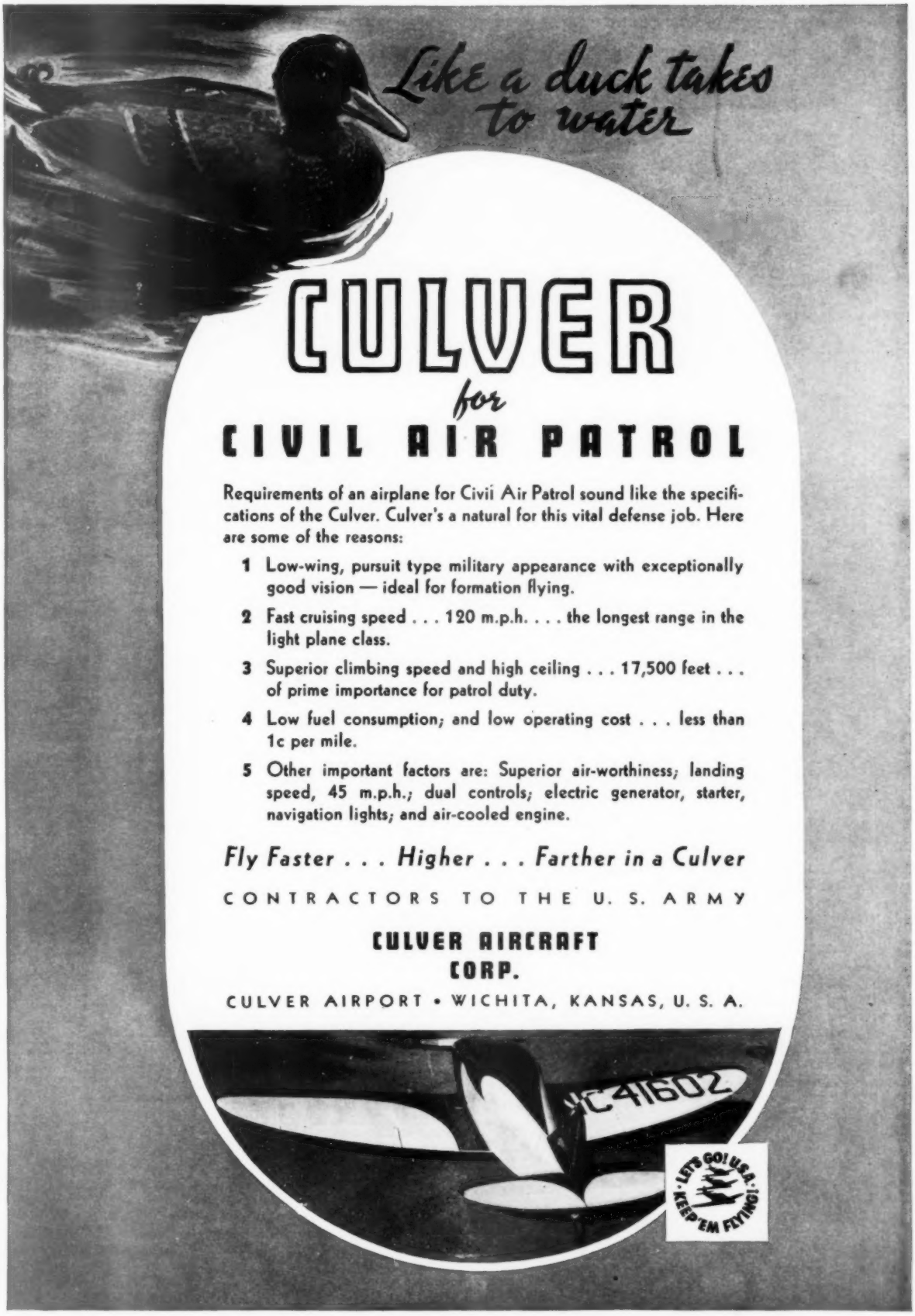
Now that it is over and has turned out happily, I am glad that it happened, for only one reason:

I learned *plenty* about flying from that!

END

DUTCH JAP-KILLERS

THIS squadron of American-built Netherlands Indies fighters is symbolic of the ultimate defeat of the Japanese. The latter now, for the first time, are facing modern American warplanes in actual combat—a condition in no way comparable to the easy-going aerial warfare the Japs have used against the helpless Chinese. The interceptors above are Curtiss-Wright fighters of the Dutch air force; they already have taken heavy toll of Jap aircraft.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5 Other important factors are: Superior air-worthiness; landing speed, 45 m.p.h.; dual controls; electric generator, starter, navigation lights; and air-cooled engine.
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The "Hudson"

(*Continued from page 23*)

heed pilots. (The company was one of the few in the U. S. with foresight to hire many good civilian pilots for testing its ships, now has some of the best in the country working for it at top prices.) Minor changes are made after the test flight and the ship is pronounced ready for delivery. American Army pilots in the Ferry Command, and civilians, fly the ships to Canada where they are taken over by Canadian or British pilots and flown from "departure points" to England. The planes fly a route across the continent that includes stopovers at Detroit and Patterson Field near Dayton, O., where they are cleared by customs officials. Extra gasoline tanks installed in the ships give them a range close to 3,000 miles. Some or all of these tanks can be later removed when the plane goes out on bombing operations.

Under actual fire the *Hudsons* have proved more than just reconnaissance bombers. They are being used as raiders, dive bombers, convoy patrol planes and are equipped with special devices for locating submarines.

No German bomber has been able yet to consistently outfight them. Only the Nazi fighters can do that and even they have been shot down by the score in thrilling air battles. The American-built ship is more maneuverable than any bomber the Germans are sending on long range duty over sea. The German bombers, it is reported, avoid combat with the Lockheeds and enemy fighters do not have the range to follow them far out to sea.

There is the story of the Lockheed on night sea patrol near Borkum, German North Sea island, which sighted a Heinkel seaplane resting on the waves. The ship was easy prey for the RAF pilots but they thought it "unsporting" to attack a resting bird. The *Hudson* dived twice at the Heinkel with its powerful wing lights flashing a challenge to "come up and fight." The German accepted. But the first burst from the British bomber's guns tore strips of burning fabric from the enemy's craft. The Heinkel's cockpit was lit up by the glow of tracers striking home. Its crew tried desperately to avoid further attack and to reach the Dutch coast, flying only a few feet above the water. After a 20-minute chase the *Hudson* forced down the Heinkel and with machine gun fire sank it.

Another time a *Hudson* on Atlantic patrol duty spotted a four-engined Focke-Wulf *Kurier* maneuvering for position to attack a convoy bound for the isle. Closing in at full throttle the RAF gunners opened fire at point-blank range. Fire broke out instantly in the German plane. It turned sharply, lost altitude and crashed into the sea. An escort vessel with the convoy went to the rescue of the German crew.

Lockheeds on coastal patrol discovered a supply ship of 3,500 tons at the entrance of the fjord north of Bergen, Norway. One bomber dived to within 50 feet of the ship, released a stick of heavy bombs with delayed action fuses and zoomed back to his lofty perch to watch the results. The sight he beheld was a flaming inferno as the ship was aflame from bow to stern.

It was a *Hudson* that first discovered the prison ship *Altmark* with British captives aboard, in a Norwegian fjord. Another was the first to report that the great German battleship *Bismarck* was on the prowl. The *Hudson's* crew flashed a warning which set the British navy on the alert. One of the most valuable convoys of the war was nearing the Irish coast, and the German battleship—mightiest for her size in the world—was out to sink it. What happened is history: the sinking of the battleship *H.M.S. Hood*, the chase after the *Bismarck*, her discovery by a *Catalina* flying boat, and the epic sea battle that resulted in her being sunk by British warships after aerial torpedoes had been rammed into her hull.

"No one knows how to start the darned thing."

Tales of the exploits of the *Hudsons* are legion. They range from simple reconnaissance expeditions or the dropping of bombs on a German ship to death battles in the skies. They begin with the first day of the war and daily there are new ones to tell. On that cold September day in 1939 when Britain and France declared war on Germany a lone *Hudson* limped home to its Scotland base. Mack Pritchett, Lockheed inspector, describes it: "The tail was almost off. The pilot reported that he had encountered a Blohm & Voss seaplane off the coast of Norway. Jerry had shot away the *Hudson's* control rod on one rudder and the vibration loosened every rivet in the tail assembly. The pilot couldn't keep his feet on the pedals. Yet he got the ship down safely, while the Blohm & Voss was a probable loss. The RAF pilot received the first DFC awarded an operating *Hudson* squadron."

Don Dunning, another factory representative, reports: "At Dunkirk the Lockheeds did a splendid job. The station where I happened to be at the time, had four squadrons of 28 ships each. Sent over in waves of 12 every 15 minutes, they protected the troops on the beach at Dunkirk by dive bombing the encircling Germans, strafing the Nazi infantry, bombing the German boats and giving protection to the British ships bringing the Tommies back across the channel.

"I saw these planes come back from the hell above Dunkirk with the upper skin of their wings wrinkled from diving and pulling out. They were never built as a dive bomber, but they served as that over Dunkirk. Sometimes we had to put on new sets of wings, an operation requiring about four hours. But as fast as the job was done the ships were refueled, loaded up with bombs and put back into the air. Each made from six to eight trips and more than 100 of them saw action. There were seven lost."

Dunning also recalls the plane that came back from France with its hydraulic system so badly shattered that it was impossible to close the bomb doors which happened to be open at the time of the attack. The landing gear was partially down, and in landing on the grass airport the pilot used the bomb doors as skid runners. The only damage was to one bomb door which had to be replaced. The fuselage was found to still be in perfect alignment.

In the early days of the war when the *Hudsons* were used exclusively as reconnaissance planes, it was found that the rear turret did not have sufficient protection against three Messerschmitts attacking from behind. Several "Tail-End Charlies" (as RAF pilots nickname their rear gunners) were pretty badly shot up as the result. One of the Messerschmitts would get directly behind the bomber out of range of its gunners, and the other two would stand off at an angle just in back the rudders, which made it impossible for the bombers' turret gunners to fire without sending machine gun bullets through their own ship's rudders. This resulted in the loss of several ships. Lockheed engineers and RAF officers decided to remove the plexiglass from the fifth window on each side of the cabin and install machine guns. This was tried

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as an experiment. The three Messerschmitts attacked in usual fashion. But this time the two flankers were shot down by the surprise fire from the window guns. Within a week machine guns appeared in the windows of the German Heinkels when they came over.

One of the most notable actions of the *Hudson* bombers was the first capture in history of a submarine by an airplane. The four crewmen and a 32-year-old Yorkshireman, captain of the bomber, tell it this way:

"Patrolling far at sea, we dive-bombed a submarine just as it was breaking the surface. A gunner shouted when he saw it rise almost on an even keel, surging up through a mass of whitecaps. We turned about to attack.

"Machine gun them," was the cry.

"Then, with all guns blazing we dived across the U-boat. Its conning tower hatch was thrown open and about 12 Nazis dropped to the deck. We thought they were manning antiaircraft guns, so we kept firing. The tracers peppered the conning tower and kicked up spurts of water all around.

"There was confusion aboard the submarine. Those on deck ran into others trying to come up. We came around again and gave them another dose. Our next time around the submarine surrendered. One of its crew held a white shirt above the conning tower and waved it violently. Our guns ceased firing, but we continued to circle. We sent out word for help by radio. Soon a large *Catalina* arrived to take over the watch, and just before dark a British warship steamed up. The next morning the sub was towed to a British port."

Another RAF pilot related:

"The other day we were looking for targets on the Dutch coast. Messerschmitts came up to us like a cloud of mosquitoes. We really tested our Lockheeds as they were never tested before. We dived the ships at better than 400 m.p.h. and that's far faster than the manufacturers ever thought their planes would be likely to travel. We had to throttle flat out for 35 minutes and the instructions allow us only three minutes at maximum. Fifty feet above the sea, still trying to dodge the Nazi fighter ships, we pulled out and rode and threw our bombers about all over the place. They took it like hawks."

These are but a few of the exploits. There are many others. Stories of widespread bombing raids over Norway and the Bay of Biscay; tales of a trail of havoc across Stavanger air field in Norway; of taking photographs of aerial-torpedo damage at Taranto; of a stick of bombs falling across a munitions dump in the harbor of Feje Island, the explosion of which tossed the plane 900 feet off its course; of interrupting a camp's Sunday dinner arrangements at Kristiansand; of an attack on the gas works at Esbjerg in Denmark. They go on and on—

Such is the Legend of the *Hudson*.

END

Fowler Flaps

(*Continued from page 72*)

Flaps, track and wing, therefore, must be stiffly steady in flight.

Manufacturing and mounting problems and structural rigidity, however, are not impregnable reefs, as this lift producing agent's ready acceptance has witnessed. When one sees the Ryan YO-51, with its phenomenal performance and speed range, the case for the long chord Fowler flap and its ally, the Handley Page slot, is assured. At present the only worthy competitor in lift coefficients is the double slotted flap, similar to that used on the Italian Piaggio bomber in 1937. With further design data in the offing we can expect to see the Fowler and double slotted flap wrestling for first place on the slow-landing, high speed fighters and super-safe commercial ships of the future.

END

Licenses

IN a special bulletin to FLYING AND POPULAR AVIATION, the Civil Aeronautics Administration has released the following monthly statistics:

	Dec. 1 1941	1940
Pilot certificates of competency	97,749	62,000
Airline transport certificates of competency	1,587	1,366
Student pilot certificates	101,011	77,290
Glider pilot certificates of competency	163	137
Student glider pilot certificates	549	484
Mechanic certificates of competency	13,849	11,005
Parachute rigger certificates of competency	608	437
Certificated aircraft	23,477	16,500
Certificated gliders	61	39
Ground instructors certificates of competency	4,617	1,775
Air-traffic control-tower operators certificates of competency	431	247
Aircraft dispatchers certificates of competency	411	345

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Waco trainers have sturdily met the gruelling test of the acrobatic training program which has already supplied more than 12,000 student flyers to our armed forces. On the line day after day, they have re-established Waco's record for reliability and ease of handling in the air and on the ground, with only a minimum expense for maintenance and service. That's why we say when you consider the purchase of a trainer, "Ask any pilot."

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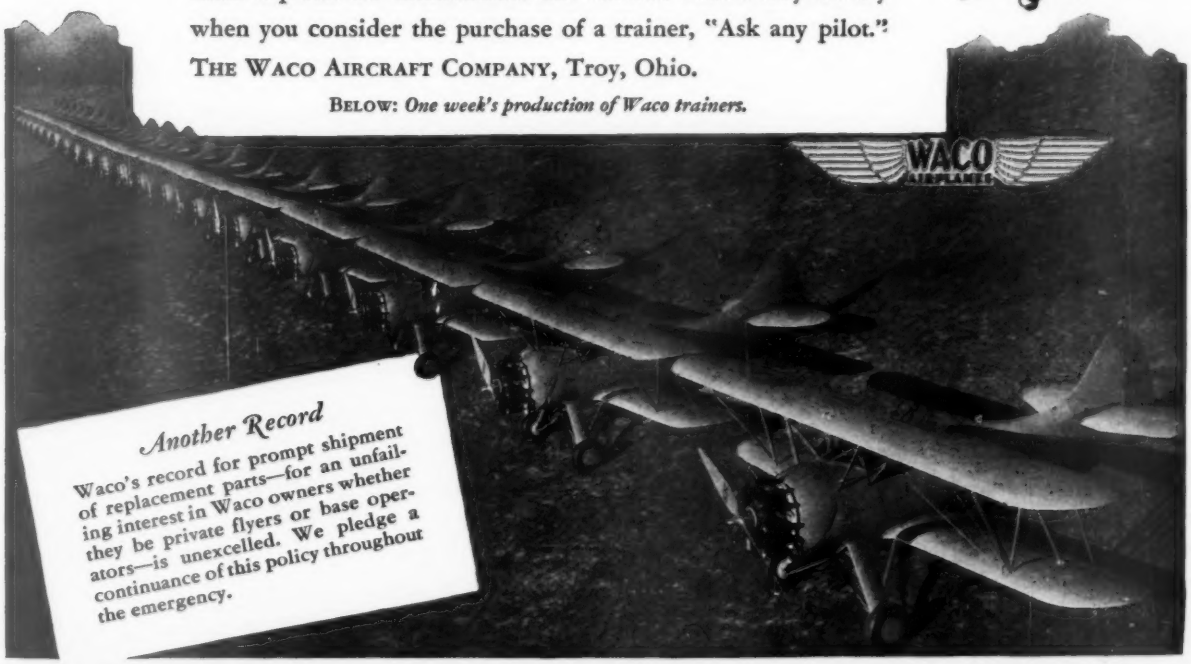

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Waco's record for prompt shipment of replacement parts—for an unfailing interest in Waco owners whether they be private flyers or base operators—is unexcelled. We pledge a continuance of this policy throughout the emergency.

THE WACO AIRCRAFT COMPANY · TROY, OHIO · U.S.A.

Lightplane Airworthy

(*Continued from page 32*)

boots should be removed at their regularly prescribed intervals to check for holes burned in the pipes. This precaution is essential as such a defect will allow exhaust gases to enter the cabin through the cabin heater, permitting possible asphyxiation of the pilot.

If there is any indication of roughness when the engine is revved up, the track of the prop should be checked. In any event, its condition should be carefully determined and any accumulated foreign matter washed off the leading edge. It is well to note at this point that many wood propellers are split along the trailing edge by careless cranking. Steer clear of the novice wearing a heavy finger ring who offers to "pull her through."

Flying through heavy rain plays havoc with the varnish on the ordinary wood prop and rapid deterioration of the wood will result unless the condition is remedied at once. Propellers should never be re-varnished on the airplane as it is impossible to maintain perfect balance under these conditions.

After checking the propeller the next step is a thorough inspection of the cabin or cockpit. Here the slogan "keep it clean" should be rigidly adhered to. During the cleaning process carefully note the condition of all cables where they pass through guides and fairleads, try all clevis bolts and pins for abnormal wear and lubricate the control system. Move all controls throughout their range of operation to check for binding and stiffness and should such a condition exist determine its cause before a flight is made.

All wind shields, windows, etc, should be checked for cracks and transparency. Occasional applications of a good commercial plastic cleaning preparation will increase the useful life of the pyralin many times and provide maximum visibility.

Never make the mistake of washing pyralin with thinner as it will attack the surface, making it cloudy. While in the cockpit inspect the fire extinguisher. It is a good policy to check the operation of an extinguisher at least once each year by pumping a small amount of fluid into a glass jar. The fluid may then be replaced and any required surplus added.

If the cord wrappings at the rudder cable splices are found to be frayed they should be replaced, particularly if you are buying the silk stockings for your passengers of the fairer sex. Wrappings (serving) should be made of beeswaxed rib stitching cord and the completed job given several coats of orange shellac. Check the gas shut-off to see that it will close and open. Several serious accidents have resulted from spring-operated shut-off valves that failed to open when the control was operated due to insufficient spring tension. While checking this unit, look for leaks at the valve and various tank connections. When the odor of gasoline is strong in the cabin be very suspicious of leaks. Do not overlook the primer and if fuel is forced out around the plunger when it is operated the unit should be overhauled or replaced.

Move your base of operations from the cabin to the tail assembly and lift the tail free of the ground. If a steerable tail wheel is used check the rudder cable bolts at the rudder horn very carefully as the added strain of steering causes these parts to wear rapidly. Inspect the wheel for freedom of movement and wear and the tire for condition and inflation. Give all wheel fittings a shot of pressure gun grease and see that the attachment fittings are secure. The structure at the tail post should be examined carefully for damage and accumulated debris. A check should also be made on the grommets provided for draining the structure at this point.

It is a good idea to brush gasoline over all hinges in the tail group and re-oil them with a suitable light oil after they have been checked for wear. Watch the terminal fittings on the stabilizer brace wires for indications of failure due to fatigue. Oftentimes the lower edge of the rudder and trailing edges of the flippers become ragged from gravel and small stones being thrown against them. If this condition is present the damaged

(*Continued on page 94*)

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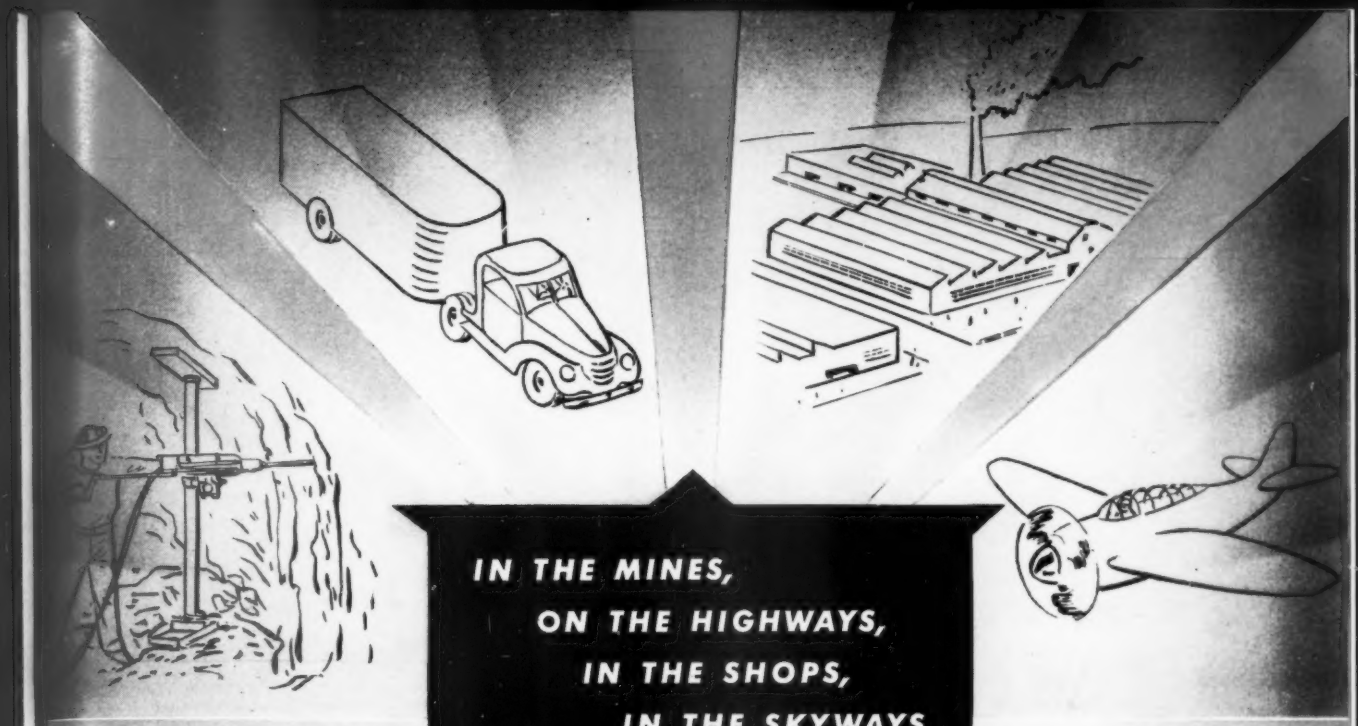

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IN THE SKYWAYS

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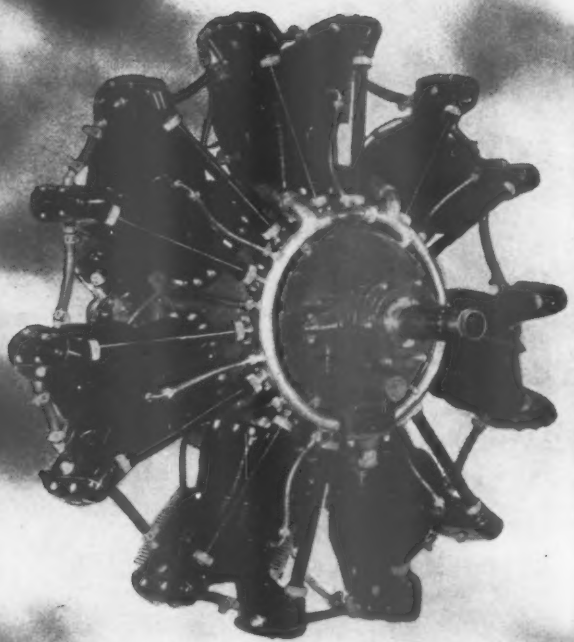

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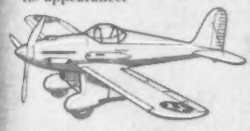
1926·First Air Corps fighter to be built in large numbers and to carry "P" designation.

1929·Six years of development finds this P-6 Hawk with greater horsepower—625—and many improvements.

1932·Speed reached 198 m.p.h. in the P-6-E Army Hawk. The single strut landing gear made its appearance.



1932·First of the low-wing monoplane type of Curtiss pursuit—forerunner of the modern fighting ship.

1937·Retractable landing gear (a 1933 development on the Navy Hawks), a speed of over 300 m.p.h., a 1100-H.P. engine, were among the notable advances on the P-36 series.

1939·This P-37 was the highest speed aircraft in Army service. Predecessor of the P-40 series, it was the only ship available in large quantities. The P-40 series has undergone five successive "step-ups" to new high performance levels in speed, ceiling and striking power.

• • •

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(*Continued from page* 90)

area should be washed with thinner, the finish softened with a little "rejuvenator" and a new strip of pinked tape doped in place. Failure to care for such trouble invites the formation of rust on the tubular structure. Where the stabilizer is adjustable, the play should be checked in the stabilizer adjusting screw. It is also advisable to run the adjustment through its entire range to see that the screw is free at its extreme positions and the same procedure will apply in the case of adjustable trim tabs. Wind up the inspection of the empennage with a check on the control cable hook-up to the elevator horns.

Drop the tail back on the ground and give the landing gear the once over. If shock cord is used see that the casing is not cut and that there are no reduced areas in the cross section of the cord which would indicate broken strands. Remember that oil deteriorates rubber and it is therefore economical to keep the cords covered with good boots. If the shock absorbing unit is an oil strut, leakage should be checked for and the level of the oil maintained. Manufacturers' specifications must be rigidly adhered to as to the grade and type of oil used for this purpose.

Check the fuselage fittings carefully for indications of distortion or cracks. To do this properly it is necessary to clean the area thoroughly. Wrinkles in the fabric of the fuselage (at the fittings) and the landing gear vees indicate a warped structure resulting from a bad landing and should have the immediate attention of a mechanic.

With one wing supported so that its corresponding wheel clears the ground, shake the landing gear vigorously to test for wear in attachment bolts and bushings. While the wheel is free it should be rotated to check for binding bearings and brakes. If this or appreciable end play in the hub is present the wheel should be pulled and the trouble remedied. Should the wheel bearings require greasing care must be used in selecting the grease as an improper grade will soak the brake lining and cause them to drag or lock. Having once dropped a wheel with resultant loss of prop and wing tip I can recommend frequent inspections of the safetying of the wheel bearing nut. When wheel pants are used, extreme care must be taken in muddy or snow covered fields to see that they are not allowed to pack full and produce a braking action on the wheel.

Tires should be carefully inspected for deep cracks and breaks which would require the replacement of the unit. Proper inflation will do a great deal towards lengthening the life of the tires; however, over-inflation must be avoided because of the strain that it imposes on other parts of the structure.

Tackle the wing assemblies next. Start the check with the ailerons, washing and re-oiling the hinges as a first operation. Include a check of the control connections operating the ailerons and look for excessive wear in the hinge pins. Pull the inspection plates in the main wing structure and see that the rib stitching is intact. While the plates are off "strum" all cross bracing. Should a loose tie rod be found, have the structure checked over by a reliable mechanic to determine the cause. Inspect the wing spars for cracks at the strut attachment points and compression members and note the condition of the aileron cables where they pass around pulleys and through fairleads. Complete the inspection of the wings by giving the strut attachment fittings at the fuselage a careful check.

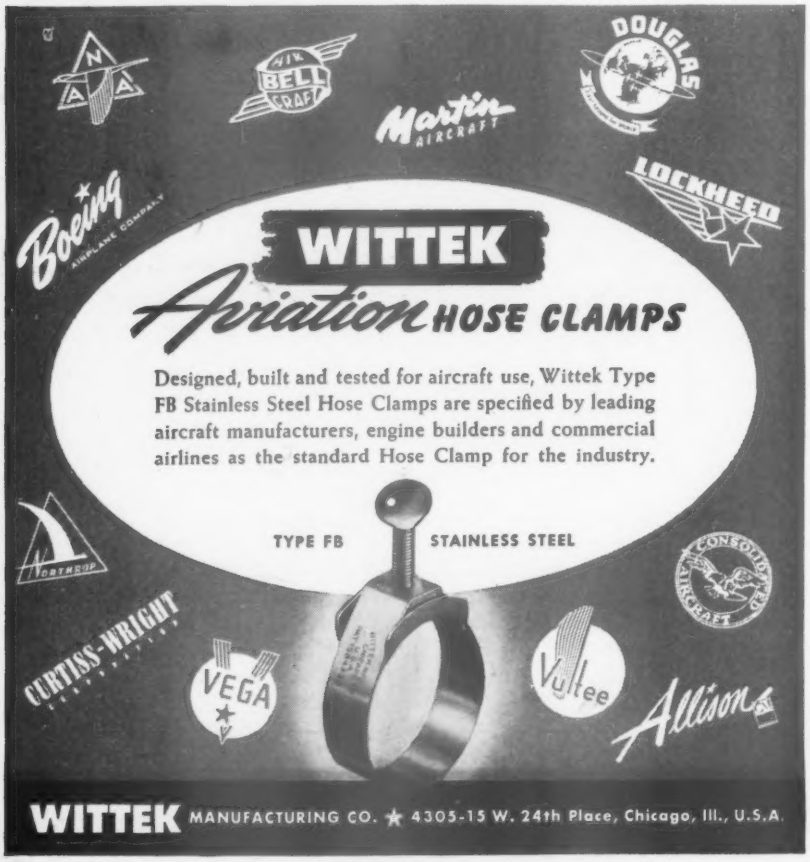
During the inspection the condition of the fabric cover on all parts of the structure should be determined. Any small holes should be repaired as soon as they are discovered while large damaged areas must be given professional attention. When installing a patch, the area surrounding the hole should be thoroughly washed with thinner, the rough edges trimmed away and the old finish softened with "rejuvenator" or repeated applications of thinner. The patch should be cut to extend well beyond the hole in all directions and its edges pinked or frayed. Properly installed patches detract little from the appearance of the plane while a "sloppy" job can make the best airplane look decrepit. After a patch is applied, give it at least three coats of clear dope followed by one or two coats of aluminum (pigmented dope). After the dope is thoroughly dried, water sand the area until perfectly smooth and apply the color, preferably with a spray gun.

The useful life of fabric covering can be extended almost indefinitely if it is carefully maintained. Keep it clean and free of grease and oil by frequent washings with a mild soap and water. Avoid the use of gasoline or kerosene for cleaning as these fluids will attack the surface to a certain degree. Keep a film of wax on the finish at all times as a protection against the elements. Any good automobile or floor wax will be found satisfactory and the "elbow grease" required for its application will draw big dividends, both in appearance and protection.

Terminate the inspection by starting the engine and, after a satisfactory warm-up period, run it up on the block checking for smoothness of operation, normal revolutions per minute, oil pressure, etc.

After performing the above outlined inspection procedure several times the job can be accomplished in a minimum of time and you may be assured that your reward will come in the feeling of confidence that will be experienced in flying an airplane with which you have become so well acquainted.

END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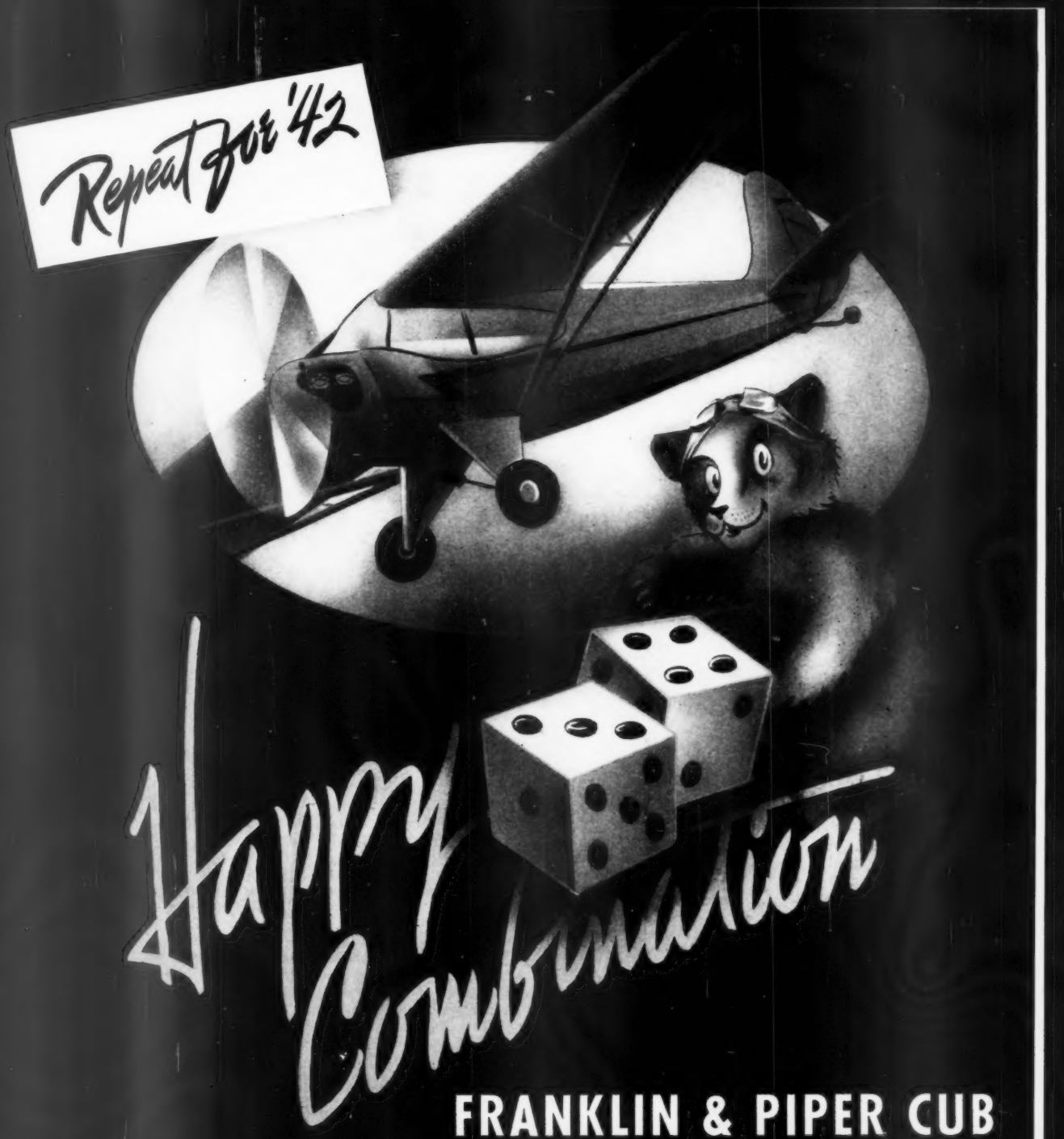

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Bombers Across

(*Continued from page 17*)

get the experience of one of our pilots who had "George," which is what we call the automatic pilot, go crazy on him at 11,000 feet two hours out over the ocean. It threw the ship into a spin from which he managed to recover at about 1,500 feet. He returned to Newfoundland where he smoked about a package of cigarettes before he could manage to tell someone what happened. . . .

At last everything was ready. I shut off the engines to be "topped up." This means the gas man fills your tanks to the last drop they will hold, just before take-off.

Contrary to popular belief, we do not fly in formation. Each ship goes entirely on its own. We were the third ship off. I held it down to 115 m.p.h. before lifting her off. Thirty minutes later, I levelled off at 10,000 feet as the coastline slid under the wing. Once trimmed, I put "George" on and sat back to start navigating.

We fly in half-degrees and half-minutes, changing courses 11 times, whether we fly the rhumb line or great circle course. One hour out, I requested a radio bearing from the field we had just left. Another one 15 minutes later agreed and placed us south of our course. I altered course and ordered radio silence. We must not use the radio for transmission until in very close to our destination—and then only if necessary.

We could no longer see the ocean, as we were flying above a solid overcast. I had taken off using fuel from the left front tank; we switched tanks every 15 minutes. I was running on the cabin tank now, with the wing tanks shut off. I sent the radio operator back to shut the cabin tank off while I turned on the bomb bay tank. My system was to check each tank before I got too far out to turn back, in case one did not feed properly. It also is necessary to keep going back to the front tanks every once in a while, because they have a "spillback" into them of about 16 gallons per hour from the carburetors. If they are not kept below full, that precious gas just spills over into space.

I was rapidly discovering that there was plenty to keep me busy on this trip. I made my hourly recording of gas tank readings, engine temperatures, manifold pressures, etc. Our ground speed was 189 knots or 217 m.p.h. We had a good tail wind.

Fiddling with the strap on my Mae West, I suddenly remembered I had neglected to tie the rip cord of the rubber dinghy to the ship. We tie it to some part inside the ship. Then, if we come down in the ocean the idea is to throw the rolled-up dinghy out into the water. The rip-cord jerks open a bottle of carbon dioxide inside the dinghy, and inflates it. So, I trimmed the ship a bit nose heavy to compensate for my weight as I walked back into the tail end, then went back and made the rip cord fast.

I though to myself what a slim chance I would have of getting that ship, overloaded as it was, down safely into the rolling swells below. I wondered if the plastic nose would collapse like an egg shell on impact. If it did the whole airplane would scoop in water and probably go down like a submarine in a crash dive. Even if I did get it down safely, what chance was there to be picked up in the middle of all that ocean? I snapped myself out of that mental wandering, when I found myself wondering how many trillion gallons of water there were in the ocean.

We were running into rain now, and a glance at the outside air temperature showed it to be 4° centigrade. I put the mixture controls in rich and threw the carburetor heats on "full hot" to prevent icing. I hated to do that, because carburetor heat increases the fuel consumption. Turning off the cockpit light, I ran a flashlight out along the wings to see if we were taking on ice. A thin coat of rime was beginning to form on the leading edge. I throttled back and descended to 8,000 feet, being careful to keep the airspeed needle steady. At this level, we found ourselves out in the clear again, flying between two layers of clouds.

The navigator tapped me on the shouder, reminding me we had to change course in two minutes. This was as good a time as any to re-trim the ship, so I took "George" off and after changing to my new course, carefully trimmed her to fly hands off. Then back on "George" again. It was nice to have that automatic pilot there. It would be an almost impossible strain for a pilot to make this trip without it and without a co-pilot either. Besides, "George" could do a better job than I. However, he needed constant attention, as the precession of the gyro would pull us off course about 3° every 15 or 20 minutes, if not constantly re-set.

By this time, everyone was "in the groove." We were on course, no ice, all we had to do was wait for an opportunity to get some star shots. There was too much cloud above us right now. We had some sandwiches and coffee, and kidded each other about the value of the breast stroke versus the crawl if we should be forced down and have to swim for it.

We had been running on the cabin tank for almost two hours now, so I switched back to the bomb-bay tank. Emptying those two tanks would balance the ship better and they would make excellent flotation devices when empty and closed off.

Back at 10,000 again. A few shots of Polaris and Arcturus put us right on course. At intervals, the radio operator would make an amendment to our weather report as he received them from the powerful control station in the United Kingdom.

We had flown all the way at 10,000 feet without oxygen (though it was there if we wanted it), and we were tired and restless. The weather report showed an 800-foot ceiling in this zone, so I decided to try to get down under it. I wanted to be sure to let down while I was still over the ocean. I had no desire to crash into the side of a mountain.

Finding a hole, I dove down through it, keeping an eye on the water below. I pulled out at 800 feet with the clouds just a few feet above me. It occurred to me

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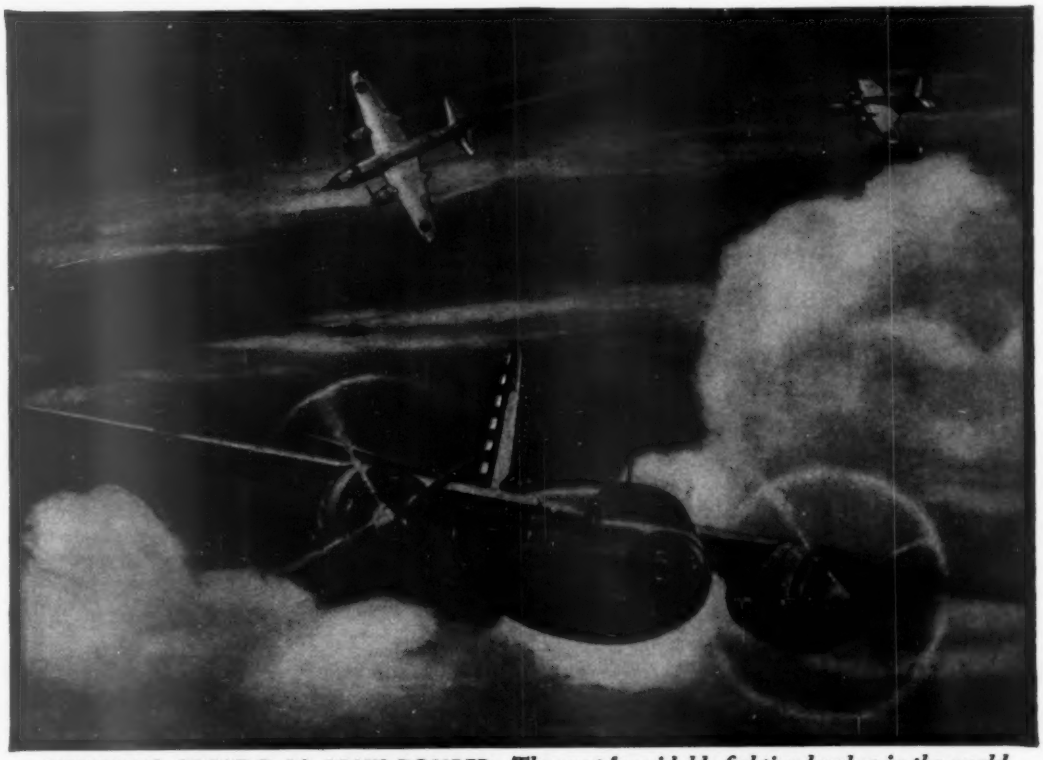

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that any Jerry pilot who might be out this far with a long-range Focke-Wulf *Kurier* would certainly never see me down here.

After a half-hour of ducking around showers (it is inviting suicide to approach those rocky shores with the almost-nil vision afforded through a *Hudson* windshield in a rainstorm) we sighted land off to our right. It was a grand sight, even though we couldn't see very well because of the rain and low ceiling. I turned to see if I could identify it. There was no mistaking the bright green checkerboard beneath us, with its stone houses here and there across the fields. It was Ireland.

By dint of some fast, accurate map-reading we identified the exact spot over which we were flying. There was a momentary urge to set down in the first clear space. But I was paid to deliver this airplane to a given airport, not just to get it across the ocean. I decided not to ask for any radio bearings. I knew where I was and there were 16 other ships coming over that might really need that assistance. That is a code we stick by: never clutter up the air with useless radio because you might prevent some man, who really needs it, from getting through.

By now the ceiling had dropped to about 400 feet and I was really worried as I followed the coastline, flying half on instruments and half contact. Suddenly the radio operator pointed out what looked like a ship ahead of us. We were flying at 200 feet. As we came closer, we could see it was a submarine. From its conning tower was coming a volley of sharp flashes. We were being challenged.

I shouted for the navigator to grab the Very pistol and fire it out the window. We had it already loaded with the color of the day. I slammed the landing gear down as an added sign of friendliness. After all, the Germans had been known to fly airplanes with RAF markings and I had no desire to be shot down at this stage. But the signals ceased and we were safely past. A few more minutes of ticklish low flying, with the operator and navigator keeping a lookout for other planes or barrage balloons, and we landed safely on an airport of our destination. Upon taxiing up to the line, I was told that mine was the day's first ship to arrive.

Our luggage was loaded into a taxi and we were whisked away to report to Customs and present our passports. Our secret papers and reports were taken from us and burned before our eyes. I made out a brief report on my crew, the behavior of the engines and airplane and, after a conference with the meteorologist on the weather I had encountered en route, we were assigned a room for some much-needed rest.

In a few days we started back nonstop to Montreal—this time as passengers in the bomb-bay or a huge four-engined Consolidated *Liberator*.

We averaged two trips a month. We were well paid—and we earned every cent of it. [Reliable sources state that pay of captains of the RAF ferry commands starts at $1,000 per month, goes up to $1,300, plus expenses; navigators $900.—Ed.] We prided ourselves on doing a job well and are content in the knowledge that we were doing our part in a good cause.

At the present time I am flying the Miami-African run for Pan American Airways, a longer and more arduous route than that of "bombers across!"

END

Of Planes They Sang!

(*Continued from page* 30)

age while the singer hobnobs with Venus and Mars, gets a free ride up on the tail of a comet and finally awakes with a start. Moral: Don't eat heavily before going to bed or you'll dream of balloons.

One of the earliest pieces of music in the collection is a German song, "The Goose, an Aviatrix," published in 1802. It was written by F. H. Himmel, a contemporary and friend of Beethoven. The story describes the flight of a goose over Berlin. Looking down on the city the goose feels far superior to earthly beings, but learns on landing that she isn't as big as she thought she was. This song, too, carries a moral: No matter how high one gets in the world, it doesn't pay to become conceited.

The Institute librarian has done a remarkable job of mounting, labeling, filing, translating and reproducing the music collection. She is the general of "Fort Knox," pet name for the room in which the music collection is stored—so called because the originals in the collection are kept there under lock and key. The Institute has made books of photostatic copies of all the sheet music in the collection. Researchers read the photostatic books to find what they want, thus the music is saved from excessive handling. These languages are represented among the compositions: German, Hebrew, Hungarian, Italian, Japanese, Mexican, Norwegian, Polish, Russian, Spanish, Swedish, Swiss, Syrian, French, Finnish, Dutch, Danish, Czechoslovakian, Chilean, Belgian, Austrian and Argentinian.

Most of the music written in the early 19th century and until the age of the airplane, fell into three classifications. Either they expressed the authors' yearnings to fly to China or to the moon; or they were comic songs based on the features of ballooning; or they were purely love songs. In about 1830 a song was published about "a fearful tragedy written under the influence of great excitement." Mr. Bupps "ascended in a balloon" to escape the tail of a comet which was ravaging London, "But was caught in blinding, dazzling sheets of flame which hurled him into the middle of next week."

There was a tendency to scoff at the free traveling balloon because of the pilot's inability to pick a destination, and yet there is a vein of credulity running through the authors' thoughts as they write of flying to the moon and to India. Many such pieces were written in Britain. In America during the later 1800's, then as now, the aeronautical songs had a predominantly romantic tone. One did not sing "On Our Balloon Honeymoon" because he was preoccupied with ballooning, nor did the young women who sang, "My Little Loving 'Aero Man'" in their parlors have their whole minds and

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hearts on the science of aeronautics. "Take Me up with You, Dearie" was another Sunday evening favorite toward the turn of the century.

The heroic age of aviation in the United States brought on a plethora of popular music dedicated to the pilots who crossed the Atlantic. Except for Lindbergh, who probably holds the all-time record in number of songs, Amelia Earhart seems to have been the most popular subject of aviation-theme music. However, Chamberlin, Post, Coste and all those "greats" who followed Lindy heard paeans sung in their praise. "Chamberlin, We're Proud of You" and "Byrd, You're the Bird of Them All" were typical of this type of music.

John Philip Sousa wrote a stirring tune called "The Aviators' March." Martial music doesn't occupy a very large niche in the files of aviation compositions, but there are a few worthy of note. The "Battle of the Marne" came out in 1916, and 10 years later Maj. Alex P. de Seversky, noted airplane designer and writer on aviation, showed another phase of his versatility by composing "Over Land and Over Sea, Song of the American Air Force." His wife was co-author. The "NC-4 March" made its appearance in 1919. In 1928 came The Victory March, "Mitchel Field or Heaven" by Prof. August Joseph Koehl. About the same time, all the attempts to cross the Atlantic inspired the "New York to Paris March."

To aviation people the principal enjoyment of aviation music is in the illustrations on the cover. Perhaps the most lurid adorn the covers of "Battle in the Sky" by J. Luxton and "Luftflotten-Marsch," a German piece dating to 1912. Both covers feature flaming dirigibles. In the "Battle in the Sky," you see the flying ship surrounded by dog-fighting planes, just after one has crashed into the airship, setting it afire and spilling burning splinters and a man tumbling head over heels toward the sea below. The "Luftflotten-Marsch" cover is more sinister. Brilliant red, yellow, blue, against a jet black background, picture a burning Zeppelin falling into the sea while battleships train their searchlights and heavy guns on a nearby land battery.

Most covers are more sedate, ranging from outlandish flying monsters to a picture of Anna Held singing a favorite from "Miss Innocence," "We Three in an Aeroplane":

> Come take a trip with me
> Not on the land or sea—
> Up in the sky a way we'll fly,
> And there we will happy be.

In one little heart-throb song called "Tell Santy I Live in a Shanty," a little girl is wistfully pulling at the arm of a man about to step into his airplane en route to the North Pole. "In My Airplane That's Built for Two" has all the love things, and a minimum of aeronautics; (1) stars, sky, setting sun (2) interlocked hearts on the fuselage of (3) an airplane with a man sitting in the front seat singing to a woman also in the front seat:

> Come with me and you shall see, my pretty one,
> The wonders of the moon and stars and of the sun;
> We'll sail above the world, my love,
> Into the blue in my aeroplane that's built for two,
> Just me and you.

My nomination for funniest piece in the Landauer collection is one titled "Three Hundred Years to Come," written by one W. H. Freeman somewhere toward the middle of the nineteenth century. It begins:

> People have named this the era of wonders—
> In ages to come, they'll look upon its blunders

and gets well into the subject in stanza two:

> Horses, in those days, will not be distinguished,
> But read of, as animals long since extinguished.
> . . . But then, as 'tis now, there'll be no lack of asses.

It qualifies as an aeronautical selection through stanza three:

> When from fatigue folks require recreation,
> On a fine summer's evening, without hesitation,
> A trip they may take to Vesuvius or Aetna
> And finish the evening, if lovers, at Gretna;
> If tired of the earth, they will call a balloon,
> And go to a Rout, or a ball in the Moon!
> . . . Debtors will, (from bailiffs hieing),
> Call for their wings and take to flying!

This author thinks that circa 2150 airplanes will make it possible to put the North Pole in the British Museum and to preserve Halley's Comet in a bottle. At that he showed a little more imagination than the songster who wrote:

> Since Katy the waitress became an aviatress the boys are all up in the air.
> She used to give the fellows a smile now and then
> But since she took to flying she looks down on the men.
> How are you gonna keep 'em down on the ground
> When their hearts follow her everywhere?
> The boss says she can have her job back any day
> But she says being on the level doesn't pay.
> Since Katy the waitress became an aviatress the boys are all up in the air.

The Institute's collection includes about 40 compositions about Zeppelins, mostly in German. One called "You're Just a Wonderful Baby Doll" made the grade because it was the first song carried as mail by the *Graf Zeppelin* on its famous world flight.

There's many a laugh in this collection, and not a few tears. It can give you a thrill a minute; but best of all, like a good camera, it has stopped the furious action of history in many cases and preserved the essence of an era in pictures, words and music.

END

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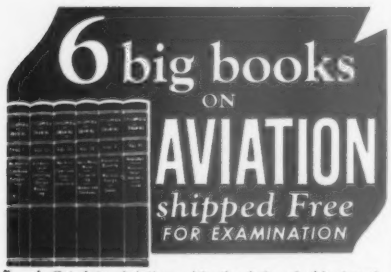

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Quit Stalling!

(*Continued from page 67*)

tually a spin, in fact in all those cases mentioned, no spin would have occurred had the plane been stalled at a safe altitude. The aircraft would have fallen off into an incipient spin and recovery followed after a quarter turn or so. The trouble lies in the fact that after a ship is stalled, several hundred feet are required for recovery regardless of whether the ship is spinning or not.

Unfortunately a pilot is just as dead be it a spin or a spiral that kills him. The second question logically follows, which is: "What should be done to eliminate this hazard?" The answer is coming rapidly in the non-spinnable plane, of which there are a few on the market. But such an aircraft will not satisfy all pilots, many of whom like to maneuver their craft, side-slip, do loops and other acrobatics. At the present stage of the game it seems impossible to design a plane for acrobatics and yet make it unspinnable. As long as we have maneuverable planes, we are likely to have planes that stall.

There is but one way to solve the present problem, and that is by constant practice of the basic rule of safe flight: *keep flying speed!* To learn this thoroughly there are several exercises that will develop and maintain the senses at a point where they will act as a veritable alarm clock when that ever-menacing stall is imminent. These exercises are so good that they have been used in the Civilian Pilot Training Program, with the result that accidents from the stall among CPTP students have been practically nil compared with those occurring among other fliers.

To begin with, we fly with our senses of sight, hearing and feel. In instructing students in a glide we often say, "See it! Hear it! Feel it!" And by "feel," both the deep-muscle sense and the control-stick feel is implied. The first lesson therefore, is to regain some of those lost senses.

The first exercise is that of the glide. Can you establish a *normal glide* without the aid of the airspeed indicator, so that it checks within plus or minus three m.p.h.? A normal glide is the airspeed greater than the stalling speed, at which a plane will land without undue float, and at which perfect safety and control is had. A glide slower than this is dangerous because it is too near the stall; a glide faster than normal is dangerous because the pilot doesn't know exactly where his plane will land. Learn to glide at the normal glide and no other—and don't do it by the airspeed indicator! Use that instrument as a *check*, and not a first line of defense! If a pilot will always glide at the normal speed he will be able to do it without thinking when that tense moment comes during a low turn, a forced landing or a quick maneuver to avert collision.

Practice establishing the normal glide by (a) sight (b) hearing and (c) feel. Learn where the nose should appear below the horizon and memorize it. Notice the angle that the wing chord makes with the horizon (and this, incidentally, is invaluable on a day when fog or haze obscures the horizon). Next, listen to the wires and the sound of the wind—know that pitch and vibration so well that anything else is a source of displeasure to you. That certain sound is better than an airspeed meter because it never gets oil, dirt or rags in it! Finally, feel the control with your fingertips, and get used to the normal glide response. There is a difference between 80 m.p.h. glides, normal glides and 30 m.p.h. glides! If your plane has a normal glide of 55 m.p.h. use that speed and no other. Your deep muscles will inform you of it by the G's you feel: at 80 m.p.h. a tug on the elevators will cause more inner feeling than a tug at stalling speed.

The next exercise is invaluable. It will be good later on when you fly a strange plane for the first time, which will be mentioned again in a moment. It has been used successfully in student training and is used by both the Army and Navy . . . the *stall.*

There are at least three kinds of stalls, with variations thereof. The two we shall use are:

(1) The full stall.
—power on, and power off.
(2) The approach to the stall.
—power on, and power off.

The first type mentioned is the easiest. It gives the student a feel of the plane throughout the speed range from almost zero to full cruising. What is more, it teaches him how to land (if executed with power off) in a fully stalled position. It permits the veteran pilot to observe what happens when the plane he is flying becomes stalled.

To practice the full stall, obtain a reasonable altitude, say 2,500 feet. Throttle the engine and commence to ease the nose up slowly, with gentle pressure on the stick. Raise the nose until it is slightly higher than a three-point or landing position, and hold it there. Do not allow the nose to go any higher, and do not permit it to drop, even slightly. This will require constant feeling of the stick pressures, little delicate movements that will inform the pilot of just what is going to happen should he move the stick all the way back.

As the stick comes back, be alert. Feel the plane, listen to it, watch it. Develop those three senses, and know at all moments what is going to happen. Feel that burble point as the plane approaches the stall. Notice that the ailerons become more and more ineffective.

That brings up the question: "Should I use my ailerons in the stall?" The answer is: "Use ailerons as long as they are aerodynamically efficient." That is, as long as the lift-drag coefficient of the aileron is such that flight is augmented by their use, the control is of value. Obviously if there is 40, 35 or 30 m.p.h. over the aileron it will lift more than it drags. When only 15, 10, or five miles of airspeed are left, there will be a tendency to yaw the plane and make an incipient spin rather tight or erratic.

Thus if the wing drops before you feel the burble point, pick it up with aileron, remembering that as the plane flies slower

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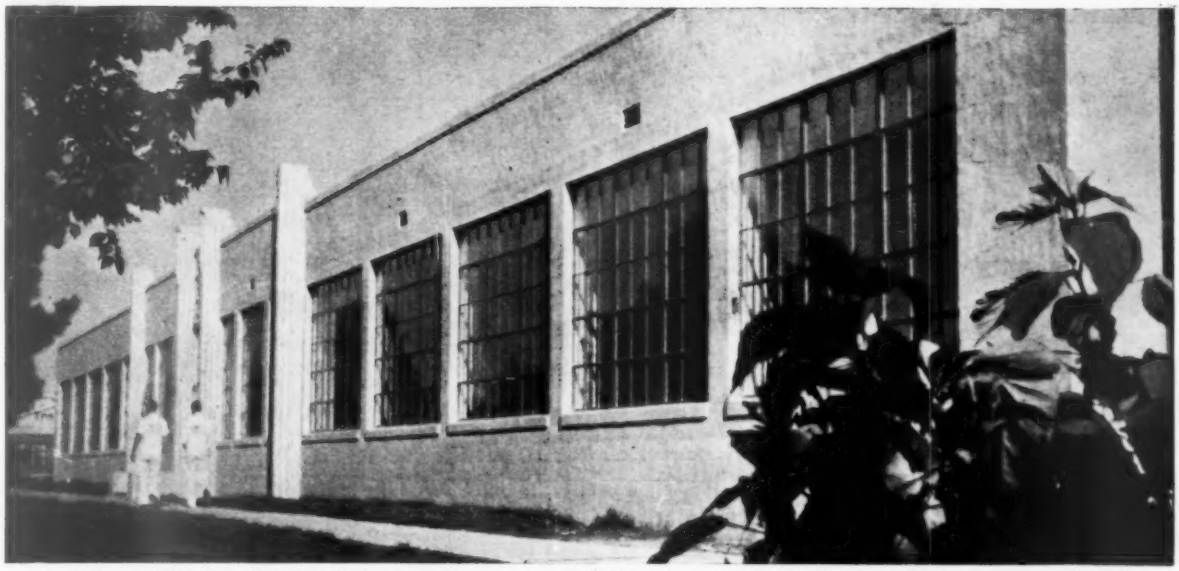

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a bit of rudder will be needed to counteract the yawing effect of aileron drag. Finally, as the stall is reached, no aileron should be used. If the nose swings from the heading, correct it with rudder alone!

When the stick is all the way back the stall is complete and the nose should still be in place on the horizon. As the nose drops, recovery should be made by pushing the stick briskly but gently forward, and regaining that old pal, the normal glide.

Little need be said of the power on stall, except that the nose must be raised slightly higher and the feel of the controls is not as clear, due to the blast of the propeller stream. The plane may be more difficult to control, but less altitude will be necessary for recovery.

The second type of stall—the approach—is more difficult because a keener realization of speed is required. With the engine throttled back, raise the nose to approximately the same position—that of three-point landing. Now by dexterous feeling of the stick, *hold the nose* in place, allowing it neither to raise nor lower. As the speed decreases, develop those three senses: see all, hear all, feel everything. Between 30 and 40 m.p.h. (in most lightplanes) a sudden quiver, bump, or "burble" will be felt. That is the result wanted, and on the indication of that phenomenon push the stick briskly but gently forward for immediate recovery. That means of course the normal glide, not a violent dive.

The approach type of stall may also be practiced with power on, but the difficulty in finding the burble point increases. The main object in all these exercises is to make one's senses sharp, to know that dangerous stalling-point so well that it is unmistakable. Then it won't be so hard to follow those excellent three rules of flying—"Keep flying speed, keep flying speed, keep flying speed."

How often should stalls be practiced? At least once each flight if you are a week-end pilot, or at least once every month if you fly more often. It is so easy to go stale, to lose that necessary feel, to forget how the wires sound or where the nose should be. But astonishingly enough, it all comes back with a little careful practice.

If you are flying a new or strange plane—go up and do some stalls! Find out how it lands (a full stall) find out what happens when the controls get mushy (an approach to the stall). Then try a few turns—and you'll *know* when the danger point is reached. Remember—a plane stalls at a higher airspeed in a steep turn . . . but if your senses are keen, you'll realize it immediately.

As for the spin itself, present thought tends to disregard the actual spin as a maneuver. The present trend of thought is that spins should be practiced only to develop a uniform method of recovery, and that the best thing to know about a spin is how not to do one accidentally. Follow the rules laid out above, practice stalls and learn to see, hear, and feel—and you'll never win first place in a CAB report.

END

Navitrainer

(*Continued from page 70*)

hangar floor, or the handiest space available, the instructor can be present throughout the synthetic "flight," supervising several students at the same time. He not only acts as pilot, manipulating the trainer by artificial means in the same manner as would a pilot in the air, but also controls the conditions, such as wind speed and drift, under which the "flight" is made.

The machine consists of a wooden frame about seven feet square, mounted on wheels two feet off the ground, and supporting a navigator's "cockpit" so constructed that it revolves through 360° around a drift meter tube extending up through the center. The wheels supporting the wooden frame are operated by an electric motor which can be speeded or slowed to simulate speeds of from 150 to 400 m.p.h. in any direction of the compass. The motor is geared according to the scale of the map laid on the floor or on the Windtroducer beneath the frame, so that if the plane's average speed is 300 m.p.h., and the map scale is 10 miles to the inch, the Navitrainer will move 30 inches in an hour. With enough patience, a sofa pillow and a few chicken sandwiches in his pocket, the student can cross the Atlantic, circle the British Isles and return the same afternoon. If he is really ambitious, he might keep right on going and circumnavigate the world, without even running off the hangar floor.

In front of the navigator are the radio direction finder, a plotting table and an instrument panel mounting the essential navigation instruments, an air speed indicator, clock or chronometer, drift meter, compass and thermometer. A navigator compass is also mounted near the navigator's seat. Below the frame is the Windtroducer, which at the will of the instructor produces all the vagaries of the wind with which the student navigator could possibly have to contend. Beside the plotting table hangs the communications apparatus, a set of earphones and a transmitter for receiving radio bearings and giving directions to the pilot.

The instructor, or an assistant under his direction if he is supervising instruction of several student navigators at one time, first manipulates the Windtroducer, radio compass and other apparatus by which the conditions facing the student on an actual flight are simulated. Taking his

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drift measurement from high or low altitude, over a glassy sea, wooded terrain or desert sand, as the case may be, and comparing it with other data from his instrument board, the navigator computes his position. If he is off his course, he communicates the necessary change in compass bearing to be followed in order to get back on his course. Exchanging his role of "Master of Winds and Weather" for that of pilot, the instructor corrects the heading of the "plane" by turning the round platform on which the student is seated in his "cockpit," and makes whatever other changes in the instrument readings that would naturally follow.

In this manner, the instructor can "track" his student and observe how he uses all the little tricks of the navigating trade to determine that all-important question, "Where am I?" Whether he determines his wind speed correctly by use of the double drift method, and how rapidly and accurately he computes his position and plots his course are only a few of the things the instructor can gauge when the student is performing before him instead of in the air.

Night flying with its special problems in dead reckoning, including the application of celestial navigation, also can be simulated with the Navitrainer. Precomputed data is conveyed to the student navigator, who performs all other operations necessary except actual taking of a sextant sight, this being a part of the training which is better practiced in the air, where he will experience the difficulties resulting from rough air, minor turns and such hard realities not easily simulated.

All navigation, of course, including pilotage, dead reckoning, radio and celestial, must be brought into a composite picture and plotted before the result can be used to maximum advantage. Each one is only a part of the general scheme of getting a plane from one place to another. He may use celestial navigation and radio navigation, and even to some extent pilotage, but it must all be reduced to what is generally termed dead reckoning, that is, plotting, estimating and computing the results of all the various forms of navigation utilized to determine course and position.

Aside from the practice of air navigation, the Navitrainer also can be useful in many other ways. The instructor can easily demonstrate the essential problems of navigation, thereby eliminating much of the complex blackboard theoretical explanations. Many of the problems of search, interception and rendezvous in moving to and from bases and targets can be readily illustrated. It can be invaluable in showing how to install a magnetic compass, in demonstrating methods for ground and air swinging compasses, and for other instrument checks such as installation and check of drift meters and radio devices. Experience has shown that the realism does not stop short of the little beads of perspiration that dampen the navigator's brow when the instructor asks that inevitable question, "Where are you now?"

The problem of navigation has always been of greatest importance to Army flyers. Airways in the continental United States and many of the over-water routes are supplied with weather information at frequent intervals. There are marker beacons, radio compass stations and all sorts of modern devices to give aid and comfort to the flyer following an established course. But much of the Army flying is between points off the regular routes. The Army pilot makes use of these navigation aids, but he has to be prepared to get along without them entirely. In war, of course, all radio may be silenced at any time. Hence the importance of air navigation to the military pilot.

In furthering navigation training the Navitrainer will aid the whole pilot training program. It is easy and inexpensive to construct and can be built from non-critical materials. It gives useful preliminary training under the eye of an experienced navigation instructor, while at the same time releasing the pilots that would be required to fly planes under the present system of instruction in the air. Proximity to the sea or other special terrain is no consideration and costly radio installations on the ground and in the air can be done away with to a considerable extent. It can be operated at little cost and in all kinds of weather. Perhaps most important than any of these reasons is the time it will save in the training program.

Lieut. Col. Carl J. Crane, the designer of the Navitrainer, already is well known in the Army and aviation circles. He was recently awarded the Mackay Trophy with Maj. George V. Holloman for his work in development of a blind landing system at Wright Field and for many years has been associated with Col. William C. Ocker in various phases of blind or instrument flying. He and Colonel Ocker have written a book on that subject. He is a graduate of the University of Dayton and several Army service schools. His present station is Luke Field, Phoenix, Ariz.

END

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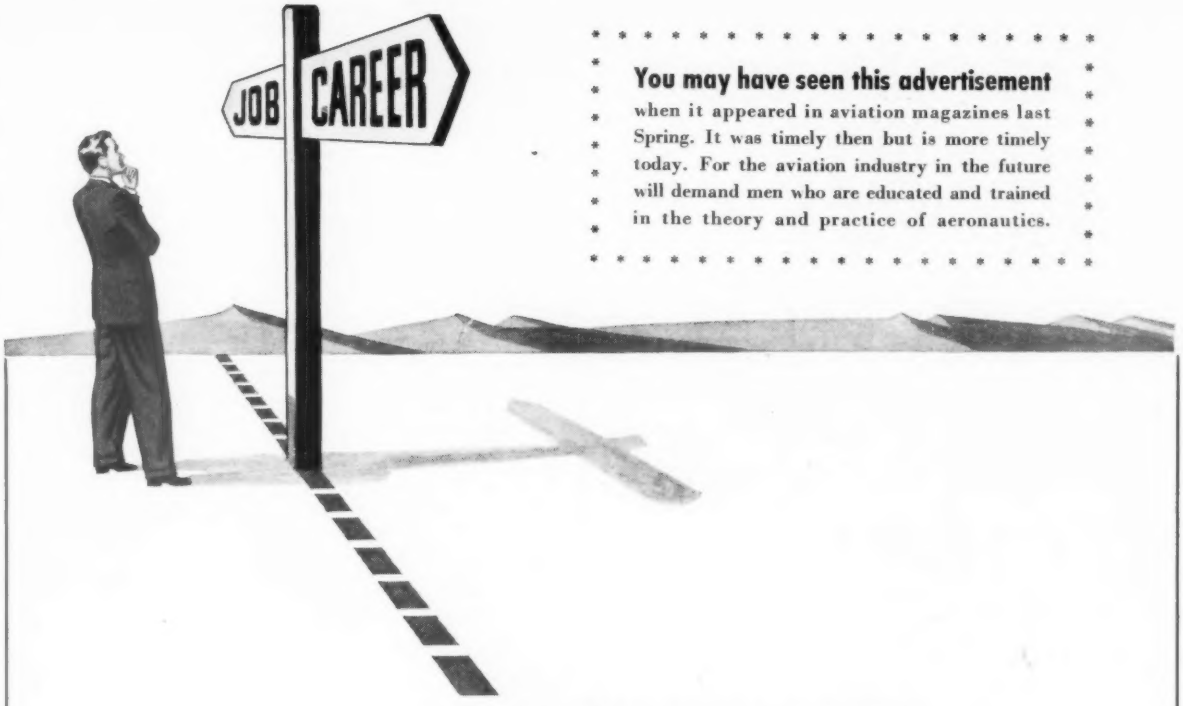
Jan. 27	The Institute of Aeronautical Sciences Honors Night dinner held at the Waldorf Astoria Hotel, New York, N. Y.
Jan. 27-30	Tenth Annual meeting of the Institute of Aeronautical Sciences held at Pupin Physics Laboratory, Columbia University, New York, N. Y.
April 23-25	Fifth Annual Southwest Aviation Conference at the Muehlebach Hotel, Kansas City, Mo.
May 1-3	New England Aviation Conference, Providence, R. I.



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Pilots' Paradise

(Continued from page 70)

to be free. Airplanes would not cost the Cub Fliers anything.

The idea went over like a house afire. Flying time cost only $1 per hour. A larger and larger percentage of the employees took up flying. Soon another ship was needed. This was in 1936 when production was going along at the remarkable rate of 10 airplanes per week. That wasn't enough. Mr. Piper told the club that they could have a new plane if the employees would build 25 ships in a two week period. If this was done, the 25th ship could go to the Cub Fliers. It suffices to say that the boys got their second ship in minimum time. In those days 12 ships a week was a lot. Nowadays that many ships go off the line in less than a day.

When the company moved to Lock Haven (Cub Fliers insist on calling it Cub Haven) and the number of employees grew, the Cub Fliers expanded with it, until the club now has seven ships and three instructors, who are on the company pay roll. The fleet includes five trainers, a *Coupe*, and a *Cruiser* which are busy from dawn to dusk. Flights are arranged ahead of time and a regular schedule is maintained so that all members have an equal chance to get in plenty of flying time. Three of the ships are assigned to the three instructors who treat them as though they were their own property. Maintenance of the ships is handled by the company repair department. This insures all the ships being in tip top shape at all times.

If an employee wants to fly, he may do so by advising his foreman, who will allow him to take time off from his work for that purpose. During the lunch hour it is not unusual to see a worker going aloft in a trainer with his lunch box in the baggage compartment, combining eating with a little cloud study!

At present there are over 300 active pilots in the Cub Fliers representing nearly 25 per cent of all the *Cub* employees. Of this number 85 hold their private licenses, the minimum rating allowable for taking delivery flights. Several of the pilots have their seaplane rating as well and this number will increase rapidly in the very near future. Carl Wollam, inventor of the Wollam plastic plywood pontoons, has donated a set of his pontoons to the club and soon it is expected to have an eighth ship which will be kept at the seaplane base on the Susquehanna River.

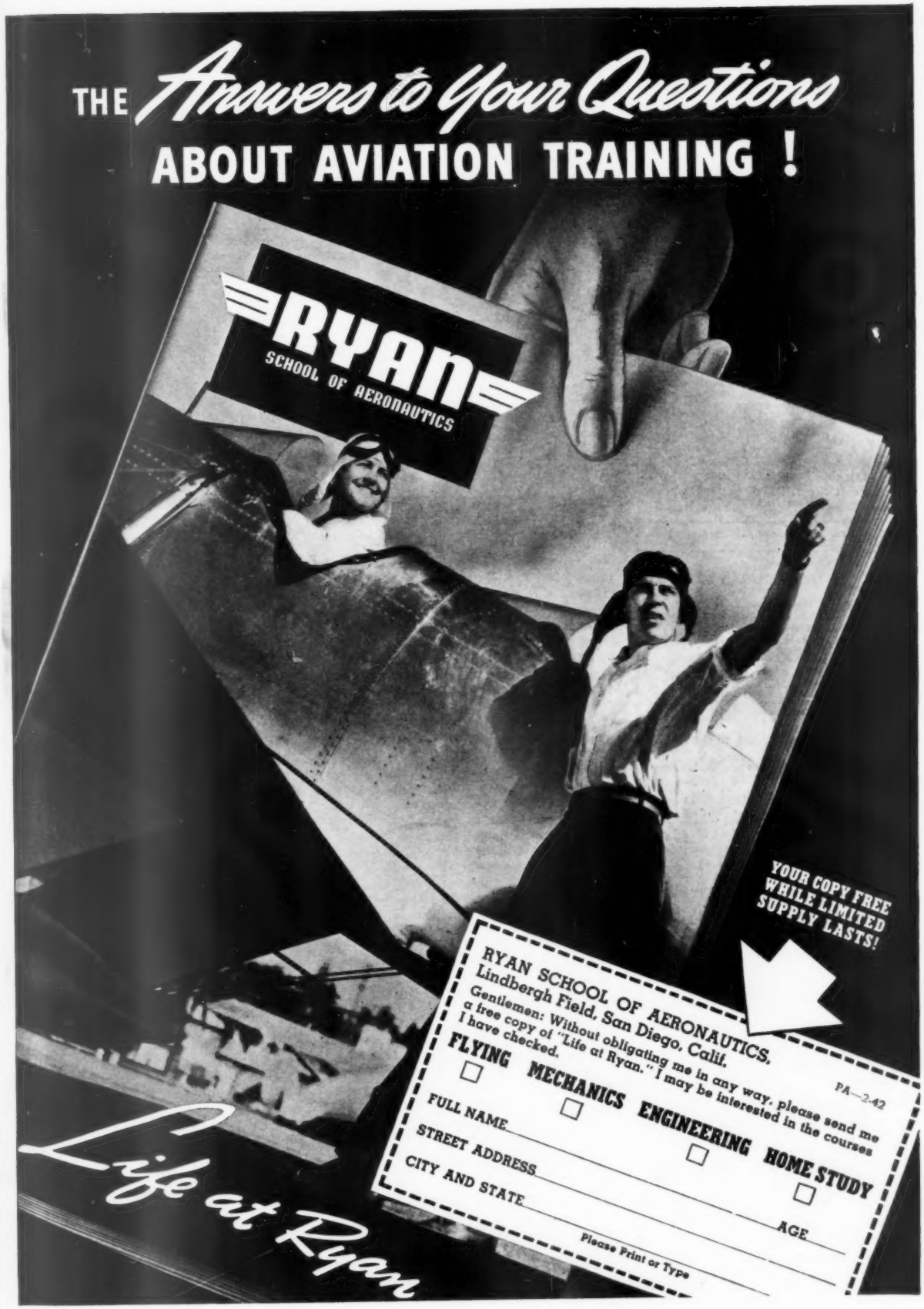
One need hardly read more to realize what a mecca Lock Haven is for the youth who is "hepped" on flying. It's hard to believe that his total flying instruction cost amounts to $8 for eight hours. After he has spent $35 for his solo time he can get his private license (total cost $43) and then be privileged to deliver airplanes all over the United States. For many, this path to piloting has been the stepping stone to greater success in aviation. Many boys, who could otherwise never have gotten their flying instruction and solo time, have come to the *Cub* factory to work and fly. Many have secured their commercial licenses.

A typical case is Al Headstrom, 19, of Bradford, Pa., who came to work at Cub Haven on March 4, 1940. Working and flying at the same time, he soloed in the summer and on May 15, 1941, hardly more than a year after he started, he had received his commercial certificate. He has since received his instructor's rating and was made one of the club instructors. By the time this is in print, he probably will have gone to one of the Army primary training schools to train Army pilots in Army trainers. Other persons have used their Cub Fliers' training as stepping stones to big time aviation jobs. One former Cub Flier stepped from a *Cub* to an air line job and is now a captain flying DC-3's. This past summer, seven of the Cub Fliers went to England to serve as ferry pilots for the RAF. Mr. Piper doesn't feel resentful at all that these lads should come to work for him and then move on after they have received their flying experience. On the contrary, he derives considerable pleasure in seeing eager young men, who otherwise never could have had the opportunity, work their way through "college," so to speak, and get ahead in aviation.

The Cub Fliers members occasionally get some interesting special assignments and opportunties. During the recent war maneuvers in which lightplanes were successfully demonstrated to the Army, nearly half of the pilots who were sent down to the war games were Cub Fliers. Last spring when the mass christening of the *Flitfires* was to be held at LaGuardia Field, the problem of getting the 48 ships flown to New York was no trouble at all. A call was sent out to members announcing the trip and nearly twice as many pilots showed up as were needed. They not only flew the entire fleet to New York but did it in a very neat mass formation which, on parade over New York, looked like a respectable military flight. Many of the Cub Fliers have performed forest patrol missions frequently. With much of the surrounding country desolate and heavily wooded, forest fires break out frequently and fire wardens in the Lock Haven district have come to rely on active support of the Cub Fliers for help. In a matter of minutes a club ship is ready to take off with a portable two-way radio installed and when over the fire, the warden riding in the ship directs ground operations. On one day alone, a club ship, so equipped, kept track of three simultaneous fires.

Each fall a competition is held among the club members to see who will go to Miami on the Lightplane Cavalcade. Each week end, spot landing contests are run in two divisions,—one for licensed pilots and one for student pilots. Usually four such contests are held and the highest ranking private pilots and students pair up to fly a club ship each to Miami. As if getting the airplane for nothing and free gas and oil down and back wasn't enough, the club usually votes a little money from its treasury to each Miami-bound member.

This abundance of flying opportunities even creeps into the love life of *Cub* em-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ployees. Aerial honeymoons are a frequent happening and the sight of a newly married couple taking off in a swirl of rice is a common sight. It need hardly be said that the honeymooners are able to make trips within their means much farther and much more interesting than if they had to go by train or auto at their own expense. The usual custom is to have a delivery arranged to some likely spot and return by train. The classiest of all honeymoons was taken by Bill Miller, assistant sales manager. He and his bride flew a new *Coupe* to Havana! Vacations, as well as honeymoons, work out as well. Most of the unattached lads sail out for California or Florida when they have a week or so to enjoy themselves and it makes for about as interesting a vacation as one could want—at very little cost.

If a kid were given all the candy he could eat, he'd be in about the same position as a private pilot who lives in Lock Haven. It's Pilots' Paradise, if there ever was one. And in conclusion its only fair that I make a slight confession, I took a delivery myself on my honeymoon!

END

Physio Flight

(*Continued from page* 34)

pressure. This figure is arrived at as follows: 760 mm. Hg pressure minus the vapor pressure saturation at body temperature (47 mm. Hg—a constant) brings the figure to 713 mm. Hg. Then 713 times 0.21 (the percentage of oxygen in the air) results in 149 mm. Hg. From this figure, 40 mm. Hg (also a constant) has to be subtracted to make allowance for the 5.6 per cent of carbon dioxide present in the air of the lungs, thus bringing the figure to 109 mm. Hg oxygen pressure.

Insufficient oxygen is an insidious hazard in flying at altitudes above 11,000 feet. Here the oxygen pressure (60 mm. Hg) in the lungs is barely sufficient to completely saturate the hemoglobin of the blood; at higher altitudes an actual oxygen deficiency in the blood is created—a condition termed anoxemia. This, in turn, causes a general oxygen want in the tissues, called anoxia. Up to this point, a normal, healthy individual, like a pilot can, by increased breathing and more rapid heart action, nearly compensate for the pressure decrease. If he ascends higher he suffers from lack of sufficient oxvgen.

Let us see how the situation is at 18,000 feet. There the barometer registers 380 mm. Hg, just half the reading at sea level. This is the same as saying that the air has just half the density at 18,000 feet that it has at sea level. Or in other words, a certain volume of air at sea level occupies about twice the amount of space at an altitude of 18,000 feet. Now, figuring the oxygen pressure in the lungs, we get $(380 - 47) \times .21 - 40 = 30$ mm. Hg oxygen pressure, which is exactly half the value necessary for the minimum oxygen pressure necessary for the blood and tissues of the body at 11,000 feet.

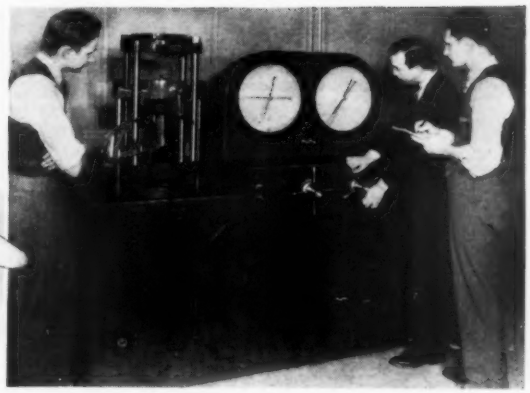
Anoxemia symptoms often are compared with those of alcoholic intoxication because of their similarity in many respects. The individual is convinced that he is rational, seldom lacks confidence and soon loses his capacity for self-criticism. Some individuals become euphoric, others morose and still others pugnacious and unwilling to listen to advice. Inability to make up their minds is common, as is dangerous carelessness. It never occurs to them to look at the oil temperature or pressure gauges, or to figure gasoline consumption, etc. Any physical or mental exertion is resented as an annoyance and navigational problems are neglected with the inevitable result of "getting lost." Difficulty in breathing, partial loss of hearing and sight, lassitude, indifference and fatigue, combined with the fact that the pilot has no warning of his condition; and contrariwise, has an exaggerated idea of his efficiency, make it obvious that flying at high altitudes without supplementary oxygen is very hazardous.

Inhaling even a small amount of carbon monoxide from the exhaust gases (which enters into a fixed compound with hemoglobin, rendering it useless for respiratory uses) at altitudes of 12,000 to 15,000 feet is exceedingly dangerous.

Without supplementary oxygen, altitudes of 24,000 feet or over are dangerous to life. A process of preparing the pilot for higher altitudes (in excess of 30,000 feet) and popularly known as "supercharging the pilot," has been developed by Lockheed with the help of the Mayo Clinic. The process is briefly this: about 30 minutes before taking off the pilot exercises on a stationary bicycle in a "decompressor room," breathing pure oxygen. This eliminates the nitrogen from his body. From this point on until he returns to moderate altitudes he must breathe only oxygen; any breath of fresh air containing nitrogen would undo all the supercharging efforts and expose him to the "bends." The flying suit must be donned in the decompressor room and a portable oxygen flask attached before switching to the plane's tanks.

This form of high altitude preparation has proved entirely satisfactory in tests, but to date its use has been in connection with aircraft where supercharged cabins are impractical because of weight and performance requirements. An absolute limit (without a supercharged cabin), even if pure oxygen is breathed, exists at 59,000 feet, where the blood boils. The flying life of a pilot operating at altitudes in excess of 10,000 feet at frequent intervals is unnecessarily shortened unless he uses oxygen in an efficient manner.

Aeroembolism is a condition where bubbles of nitrogen are liberated in the body fluids, mostly the blood, and obstruct the blood flow in the capillaries. It really is due to too-rapid decompression and occurs only during rapid ascent, the body lacking time to get rid of the nitrogen dissolved in the body fluids and tissues. Danger of aeroembolism begins at 18,000 feet (one-half atmospheric pressure), although serious symptoms are rare below 30,000 feet. Both speed of ascent and absolute altitude are the factors here. The symptoms are character-



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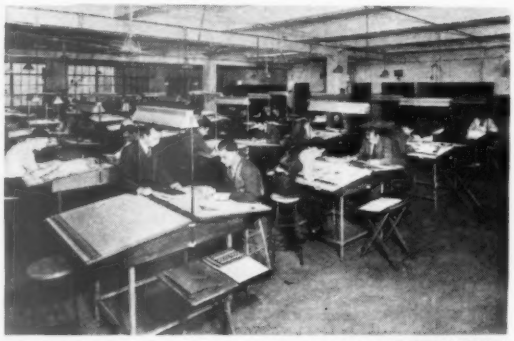

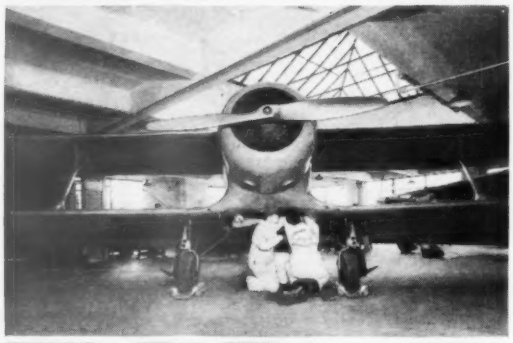

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ized by a crawling sensation over the skin, smarting and stinging of the eyelids and pains in the joints and along tendon sheaths or nerve trunks. A certain lightheadedness also is attributed to aeroembolism.

Fortunately, during a normal climb to 18,000 feet at the rate of 1,000 feet per minute, especially if the pilot starts breathing oxygen soon after the take-off, a great deal of the nitrogen will be eliminated during the ascent. Aeroembolism prevention consists of using oxygen early and in not climbing too fast. The best treatment consists in descending moderately and continuing to use oxygen.

Certain minor reactions causing errors in judgment also result from aeroembolism. After flying for a time at high altitudes a pilot may level off too early in landing, a natural result of accustoming the eye and senses to altitude and losing the proper sense of depth perception. It may be avoided easily by losing altitude in advance of the expected time of landing, or by circling the field at 500 feet before coming in. Likewise, after cruising for any length of time these perceptions become attuned for higher speeds, a little difficulty may be experienced in slowing to a normal glide to avoid coming in too fast and possibly over-shooting.

On the whole, the bodily sensations react according to a set pattern. Normally, they are more annoying than dangerous. The tendency is forever increasing physical demands on the pilot, however, and the wise one will look further into the sources of his physical capabilities and limitations as he approaches a new era in aviation. In the past there has been too little research on this subject and no available publications for the pilot. Today, fortunately, flight's importance from the physical standpoint has become a factor important enough to force its way into some recent standard aviation texts. It is hoped that more will follow.

END

WSN

(*Continued from page 26*)

ter of the Weems' enterprises—is a three-story Georgian mansion built in 1715, the same year Weems' Scottish forebears came to Maryland. One wing houses the business. Downstairs are the general offices, upstairs the school room and the commander's study. Where old Randall once watched his homecoming ships from the 25-foot long promenade atop the roof, 20th-century star gazers now ponder the heavens. The business that started in one room eight years ago has annexed room after room until even the 30-odd rooms of Randall House are hard put to accommodate both family and business.

Phillip Van Horn Weems was born 42 years ago in Montgomery County, Tenn. He is a big man, lithe, active and proud of his athletic record at the Naval Academy, where he was an All American footballer, Southeastern amateur wrestling champion, boxing champion, Olympic team member and a crew man. Weems has lived in Annapolis since 1919 when his return to the city ended his family's 75 years of absence in favor of Tennessee. Half the people in Annapolis are related to him, he says. And that could be.

As a student in the Naval Academy he was careless with figures, an oddity in view of his later work. His interest in navigation dates from 1919 when he was navigator aboard one of the destroyers stationed along the route of the NC-4 and her sisterships. Additional years of navigating the cruiser *U.S.S. Rochester* around the Caribbean gave him plenty of experience—and ideas. Twice he taught navigation at the academy, once in the post-graduate school.

Phil Weems both works and talks with swift efficiency. At the academy he was known as the "king of fussers." Even then his determination attracted attention. But what should interest all you thousands of pilots, navigators and students who use WSN methods and equipment is the tell-tale quotation beneath his name in the Academy Yearbook:

"And, strange to tell, he practiced what he preached."

END

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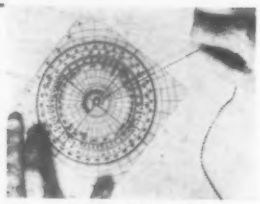

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From Headquarters

(*Continued from page 73*)

would probably have been courtmartialled.

Huffer's family is still over there now. He will bring them back as soon as he can. He worries now, not so much of the present shortage of fuel and food, but the aftermath when victory is ours and France is freed again from the heel of the Hun.

John Sherman Donaldson, pilot in the 185th Night Pursuit Squadron of First Pursuit Group AEF who distinguished himself there not only for piloting in that so-called "suicide" outfit, but also by inventing a practical device for releasing instantly in the air a machine gun jam, came to Washington the very day the war broke. In his car rested another invention which is secret and of great importance. On coming out from paying his respects to Senator James M. Mead, his car was gone, invention and all. Within four hours the police and FBI had the car back again, its contents thoroughly mussed up but nothing actually stolen.

Jack Cameron, sponsor of Major Savage's skywriting, like all friends of that business, will get a kick when he learns that British pilots on several occasion have come over Paris and, unmolested by either antiaircraft fire or Nazi planes have written in the sky bang over the Hotel Crillon a huge "V" with three dots and a dash.

From far off Libya comes the report that our best interceptors are excellent "middle altitude" fighters. Why not make them excellent high altitude fighters and then, if we want middle altitude jobs, cut down on the "revs" or compression and let it go at that?

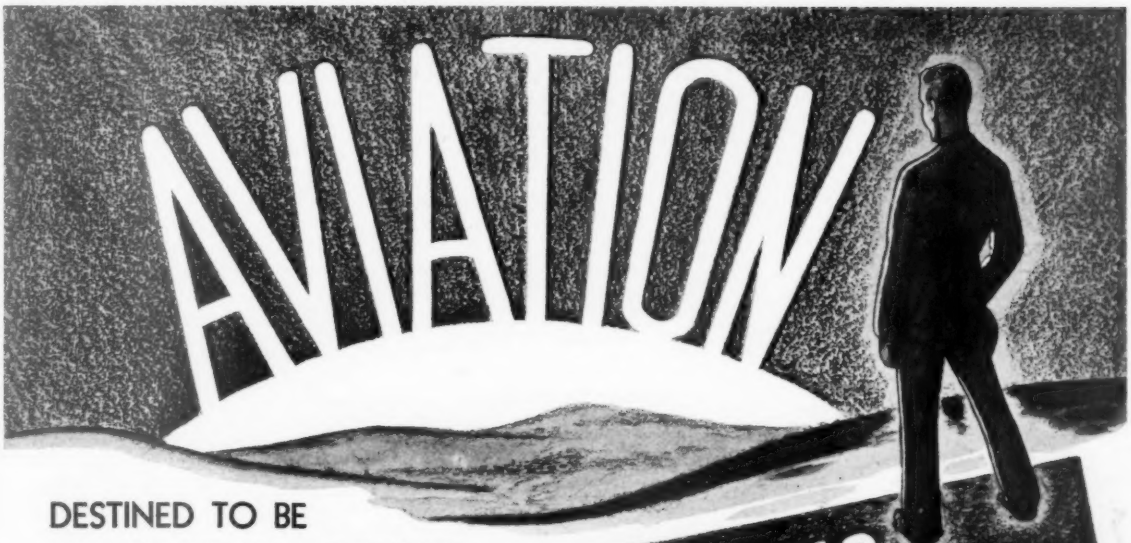
What will happen to the civil flyer now? many are asking. Despite all the palaver on that it appears that there will not be much change. It seems unlikely that the airlines will be taken over by the Government, and very soon now the Air Patrol will be transferred to the Army.

Capt. Wright Vermilya, Jr. ("Ike" to many of our readers,) has been in town from Florida "off and on" during the autumn. The State Air Force which he was instrumental in bringing into being down there is working nicely. The order of Administrator D. H. Connolly, of the Civil Aeronautics Administration, effective December 8 revoking private pilot certificates had been anticipated and "Ike's" volunteer unit will undoubtedly continue to "show the way" in pilot private activity in Civil Defense.

As for Civil Air Defense, a leaf must be taken from the books of experience in other countries facing the problem of defending the civil population and property against the novel third arm of modern warfare.

The idea of 100 per cent volunteers does not work. Not because "we humans put the dollar above patriotism" but because at least 50 per cent must be on a payroll or the organization will not

(*Continued on page 118*)



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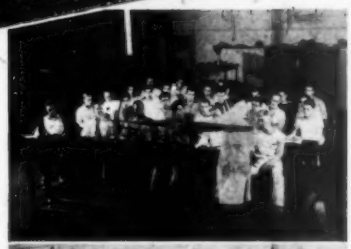

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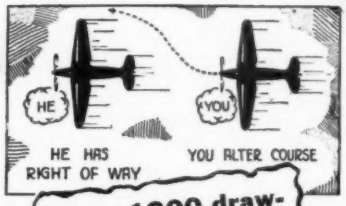

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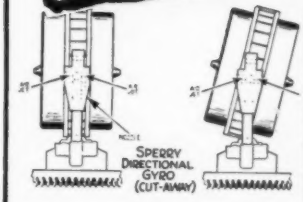

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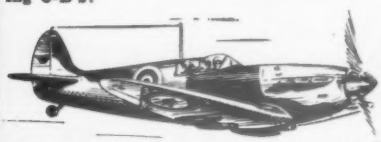

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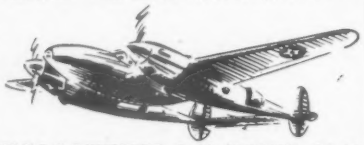

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(*Continued from page* 114)

work smoothly for long. It will be panicky and undependable when most needed. In at least one of the vanquished European countries volunteer wardens "just weren't there" when the pinch came. In England it was found that at least 50 per cent had to receive a "quid a week" or there was no organization, except in drill on the parade ground—when the bombs started screeching down.

More planes and still more planes is the cry down here now. Pretty soon we will wake up to find that in military aircraft it is the best compromise between production and performance features that spells a good airplane, not racing qualifications or one-sortie-per-week planes. Personally, your correspondent has always felt that he would rather have a common jitney than Sir Malcolm Campbell's wonderful racing freak, and most people he has met feel that way too.

Of all the amusing, if it were not so pathetic, bursts of patriotism to emanate from the loudspeaker shortly after the Congress decided that it would fight back at Japan was that of the loud-mouthed orator who said "we will spend 125 billion dollars if necessary to win this war." No world war was ever won by gold, and never will be; it will take the "blood, sweat and tears" of our citizens on the sidelines helping out those in the thick of it who hold the joystick, drop the bombs, man the tanks and wield the shiny bayonet.

It is WAR, WAR. Worse than famine and pestilence,—War, and in modern warfare the airplane is tops.

END

Troop Gliders

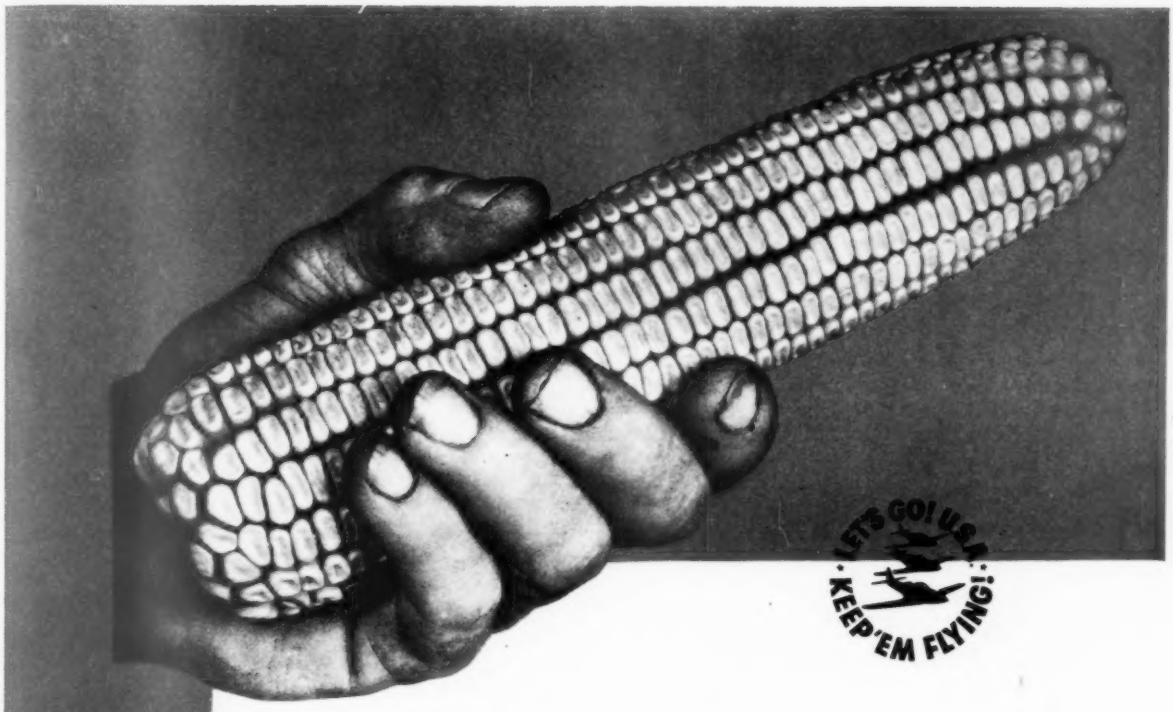
(*Continued from page* 28)

British navy and landing them in Crete. The other methods were by parachute and troop-carrying transport planes. Hundreds of the latter were landed on airports first captured by parachute and glider troops.

Of the important facts yet to be learned about the German military use of the troop gliders is the training and experience background of the pilots. First thought is of their huge reserve of glider pilots, who could be used after a brief course of training in the large gliders. A careful study of the factors involved, however, leads us to believe that, although his experience could be very helpful, the average glider pilot lacks sufficient background to do the job. It seems probable that the degree of skill required to pilot a huge troop glider with a wing span of close to 100 feet, in towed formation at night, possibly under instrument conditions, and landing it in a small field seems to indicate that the use of only qualified airplane pilots would be desirable.

This brings us to the Army's training of pilots to fly the troop gliders. Since early in the summer a steady succession of small classes of Air Corps pilot officers have been trained at the famed Warren Eaton gliding site on Harris Hill near Elmira, N. Y. This school has been oper-

(*Continued on page* 122)



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Airy Chat

(*Continued from page 4*)

PRIVATE flying naturally is going to be restricted for the duration of the war. But plane owners and pilots need not be panic-stricken over the immediate future. It was a foregone conclusion that actual war would restrict just about every peacetime function in some way or other—aviation not excepted. Everything is and will continue to be supplementary to our war effort. The airlines are able to continue normal operations on schedule only with the approval of the War Department; those airplanes or schedules for which the armed forces have need are being, and will continue to be, taken over. The same applies to the railroads, steamship lines, manufacturing facilities—even the private automobile must be subject to call at any time.

Best advice to the private pilot and plane owner is that he make every single flight *useful* from now on. Even if he only goes up for a 10-minute hop he should do so in an effort to improve his technique as a pilot, navigator and observer. There should be no more valuable gasoline wasted on "airport hopping." On every flight pilots should practice instrument flying—even if it's only the accurate use of the compass in a lightplane. The sightseeing pilot should thoroughly familiarize himself with every mile of his home territory, in the expectation that he may be called upon suddenly to fly his ship out on some mission at the request of the authorities.

Cross-country flying should become a serious ritual; navigation and map-reading should be practiced constantly and private flyers should plan every trip as thoroughly and completely as if they were required to stake their lives on the accuracy of their own calculations. By developing precision flight and observation techniques in this manner, the private flyer can and will play a vitally important role to his country's defense. He can become a valuable member of any civil aviation organization that may be formed to utilize the abilities of the many thousands of American civilian airmen.

Meanwhile, it may be expected that civil aircraft will not be permitted to be flown in certain areas and under certain conditions. Aviation gasoline possibly will become more and more difficult to get, unless for national defense purposes. The use of airways maps may be restricted. Widespread weather information already has been clamped down upon, though bonafide pilots still can get ample data for cross-country flying. Certain airways and airport radio and lighting facilities are liable to be closed down with little or no notice (this already has happened in some parts of the country). But this should be no reason for the private flyer to get panicky. He, like everyone else in the country, should take it in his stride.

* * *

OUR What's-In-The-Wind department probably will suffer for the duration of the war. Simply because many things can be said safely, in peacetimes, that might help the enemy during war. Innocent little items can help an enemy in ways we have no means of anticipating. So rather than risk an unwitting slip, we will have to deny ourselves the luxury of talking openly with our readers about any and all phases of the defense picture.

* * *

Sorry . . . MAX KARANT.

END

Letters

(*Continued from page 6*)

archives. I compliment you on the remarkable presentation in text and the superlative pictorial excellence . . . I have never seen an aeronautical publication contain such beautiful illustrations. As an old publisher, I realize the effort and expense required to produce this issue and commend you on your accomplishment.

LESTER D. GARDNER,
Executive Vice President,
Institute of the Aeronautical Sciences.
New York, N. Y.

Sirs:

. . . I congratulate you on your excellent presentation of every phase of Naval aviation. I have gone over the issue with a great deal of interest as I am personally acquainted with the authors that have covered the various phases . . . The color photographs are unusually good, and . . . most timely in view of recent events.

G. W. LEWIS,
Director of Aeronautical Research,
National Advisory Committee
for Aeronautics
Washington, D. C.

Sirs:

. . . The United States Navy issue of FLYING AND POPULAR AVIATION . . . is of great interest and instructional value in view of recent events.

L. P. ARNOLD,
Assistant to the President,
Eastern Air Lines.
New York, N. Y.

Sirs:

. . . You present a splendid story of an arm of the Navy that is extremely important to us now. The country will hear a lot about it before this war is over.

JAMES FORRESTAL,
Under Secretary of the Navy.
Washington, D. C.

Sirs:

. . . Today's mail brought me a copy of The U.S. Naval Aviation issue of FLYING AND POPULAR AVIATION. I have read it and enjoyed it in the extreme.

THEODORE G. BILBO,
Senator from Mississippi.
Washington, D. C.

Sirs:

. . . This is, indeed, a timely publication, and I want to compliment you . . . on the fine results, evidencing long research and arduous preparation . . . coupled with your special issue pertaining to the U.S. Army Air Forces, it shall prove an invaluable reference.

CHAS. I. STANTON,
Deputy Administrator,
Civil Aeronautics Administration.
Washington, D. C.

Sirs:

. . . I found your previous issue about the Army Air Forces most interesting, and I know that I shall enjoy this latest one equally as well.

T. M. GIRDLER,
Chairman of Board,
Republic Steel Corporation.
Cleveland, O.

No Relation

Sirs:

I am a little late in writing this, but please excuse it. Is Mr. E. D. Ward, who wrote "Flight for the Groundling" in the August issue . . . the same E. D. Ward who made propaganda broadcasts on the German short-wave radio some time ago? The German Mr. Ward stated in his broadcasts that he came from Iowa, U.S.A.

E. DISKAVICH.
Torrington, Conn.

● Our E. D. Ward is as American as can be. A native New Yorker, he now works in that city for one of the leading airlines.—ED.

Color Blind Pilots

Sirs:

I read with great interest the article "Pilot—Your Eyes" in the December issue. . . . There are known methods whereby one may improve his eyesight without the use of glasses, and although Dr. Schaffer mentions this fact in his article he seems more partial to the use of glasses in correcting these errors. There are, no doubt, many cases where only eye glasses can help that particular trouble.

Two years ago I decided to learn to fly . . . upon having my first physical check-up before soloing I found my eyesight checked 20/50 and although this was enough to get by on a private license it wasn't enough for a commercial. . . . I investigated every article and book obtainable on eyesight and found many interesting and helpful ideas . . . and the results are that my sight now checks 20/20 without the aid of glasses. There is nothing remarkable about this. . . . There are many other cases improved by the methods advocated in the books.

J. B. BUSH.
Daytona Beach, Fla.

● It *is* possible to improve eyesight by rigid exercise. However, one of the most heated "feuds" in the medical world is that between the optometrist and the oculist. The former advocates glasses and eye exercise; the later is the physician and surgeon specializing in the eye. Oculists contend that optometry, with few exceptions, is useless and, in many cases, dangerous.—ED.

END

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Statement of the ownership, management, circulation, etc., required by the Acts of Congress of August 24, 1912, and March 3, 1933, of Flying and Popular Aviation, published monthly at Chicago, Illinois, for October 1, 1941. State of Illinois, County of Cook ss. Before me, a notary public in and for the State and county aforesaid, personally appeared A. T. Pullen, who, having been duly sworn according to law, deposes and says that he is the business manager of Flying and Popular Aviation and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management (and if a daily paper, the circulation), etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, as amended by the Act of March 3, 1933, embodied in section 537, Postal Laws and Regulations, printed on the reverse of this form, to wit: 1. That the names and addresses of the publisher, editor, managing editor, and business managers are: Publisher, W. B. Ziff, 608 S. Dearborn St., Chicago; Editor, B. G. Davis, 608 S. Dearborn St., Chicago; Managing Editor, Max Karant, 608 S. Dearborn St., Chicago; Business Manager, A. T. Pullen, 608 S. Dearborn St., Chicago. 2. That the owner is: (If owned by a corporation, its name and address must be stated and also immediately thereunder the names and addresses of stockholders owning or holding one per cent or more of total amount of stock. If not owned by a corporation, the names and addresses of the individual owners must be given. If owned by a firm, company, or other unincorporated concern, its name and address, as well as those of each individual member must be given.) Ziff-Davis Publishing Company, 608 S. Dearborn St., Chicago, Ill.; W. B. Ziff Co., 608 S. Dearborn St., Chicago, Ill.; W. B. Ziff, 608 S. Dearborn St., Chicago, Ill.; Amelia Ziff, 608 S. Dearborn St., Chicago, Ill.; B. G. Davis, 608 S. Dearborn St., Chicago, Ill.; Sylvia Davis, 608 S. Dearborn St., Chicago, Ill. 3. That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages, or other securities are: (If there are none, so state.) None. 4. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him. 5. That the average number of copies of each issue of this publication sold or distributed, through the mails or otherwise, to paid subscribers during the twelve months preceding the date shown above is ..... (This information is required from daily publications only.)
A. T. Pullen, Business Manager. (Signature of business manager.)
Sworn to and subscribed before me this 3rd day of October, 1941.
[Seal.] M. Gnass, Notary Public. (My commission expires February 26, 1944.)

(*Continued from page* 118)

ated by the Elmira Area Soaring Corporation. Chief instructor is John Robinson, the National Soaring Champion. One class was also trained at the Lewis-Frankfort School of Soaring at Lockport, Ill., near Chicago. Training at this school was discontinued because the volume of training necessary at present is not yet large enough to justify the use of two schools.

The officers that have been trained so far will be used in the expanded program as instructors, supervisors and test pilots. For this reason they are taught, in addition to piloting the two-seater gliders in auto, winch and airplane tow, to operate the tow car, winch and towplane. The four weeks course also includes study in meteorology, with special reference to vertical air currents. Just enough soaring is done by each student to build up his skill in glider piloting, make him become thoroughly weather conscious and instill in him real enthusiasm for this type of flying. This last consideration can work wonders in stimulating a pilot's interest and initiative.

Operations at Elmira have been discontinued for the winter months due to the weather. They will be continued, on a gradual, expanded scale timed to the expected procurement of the troop gliders, at a new site in the far West.

There is every reason to believe that General Arnold's statement that we will have a glider force second to none will be a reality in the not-too-distant future. After all, most of the worthwhile innovations in glider design and use were invented here and then copied and developed abroad. With American ingenuity stimulated as it now is in the development of the troop-carrying gliders we are bound to outstrip our enemies in the quality as well as the quantity of our motorless aircraft.

END

New Director

RICHARD E. ELWELL, Chief Counsel and Director of Compliance for the Civil Aeronautics Administration, has been designated by President Roosevelt to serve as a member of the United States National Commission of the Permanent American Aeronautical Commission.

Receives Award

DR. THEODORE VON KARMAN, Director of the Guggenheim Aeronautical Laboratory, California Institute of Technology, has been chosen by the Fellows of the Institute of the Aeronautical Sciences as the 1941 recipient of the Sylvanus Albert Reed Award, conferred annually for notable contributions to the sciences relating to aeronautics. Presentation of the award will take place at the Institute's "Honors Night" dinner in New York on January 27th.

The award is given to Dr. Karman for his eminent contributions to the modern methods of designing aircraft fuselages which are now widely used in military and commercial aircraft design.

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Dwight Rohn, 1300 Monroe Street, Beardstown, Illinois	Super deluxe Chief Cont.-65	275 hr.	None	1750
Edwards Flying Service, Inc., Flushing Airport, Flushing, L.I., N.Y.	65 CA Cont. 65	300 hr.	Never	1750
Lane Air Service, Albany, Georgia	Super Deluxe Cont. 65	265 hr.	Just	1675
Ashcraft Bros. Flying Service, Municipal Airport, Lawrence, Kansas	Chief Cont. 65	500 hr.	Never	1650
Ashcraft Bros. Flying Service, Municipal Airport, Lawrence, Kansas	Chief Cont. 65	500 hr.	Never	1650
Ashcraft Bros. Flying Service, Municipal Airport, Lawrence, Kansas	Chief Cont. 65	500 hr.	Never	1650
Mountain States Aviation, Inc., 3800 Dahlia, Denver, Colorado	Chief Cont. 65	308 hr.	None	1650
Mountain States Aviation, Inc., 3800 Dahlia, Denver, Colorado	Chief Cont. 65	320 hr.	None	1650
Baker-Eberle Aviation Corp., Detroit City Airport, Detroit, Michigan	C.A. Cont. 65	290 hr.	Never	1500
O. E. Dickerhoof, Municipal Airport, Chanute, Kansas	Lyc. 65	100 hr.		1400
W. Va. Air Service, Inc., County Airport, Clarksburg, W. Va.	Chief Cont. 65	210 hr.		1395
Lenhart Flying Serv., Arpt., Marion, Ind.	TF Frnkln. 65	12 hr.		1395
Morristown Fly. Club, Morristown, Tenn.	Chief '40 Lyc. 65	362 hr.	No	1375
Cincinnati Arcft. Serv., Lunken Arpt., Cinn., O.	TL 65 Lyc. 65	285 hr.	Never	1300
Lane Air Service, Albany, Ga	Chief Deluxe Cont. 65	375 hr.	Recently	1300
Florida Aero & Supply Co., Cannon-Mills Fld., Orlando, Florida	Tandem Trainer Lyc. 65	280 hr.	No	1300
Inter-City Avia., Inc., Boston Munic. Arpt., E. Boston, Mass.	Chief Lyc. 65	825 hr.	210 hr.	1250
Tred Avon Flying Serv., Inc., Easton, Md.	Trainer Lyc. 50	236 hr.	No	1238
Richmond Air Transp., Byrd Arpt., Richmond, Va.	Chief Cont. 50	510 hr.	30 hr.	1200
St. Louis Flying Serv., Lambert Field, Robertson, Mo.	KCA Cont. 50		Recently	1175
Blvd. Arpt., Inc., Roosevelt Blvd., Phila., Pa.	TL Lyc. 65	150 hr.	No	1150
Jenkins Air Serv., Inc., Munic. Arpt., Rochester, N. Y.	TL Lyc. 65	200 hr.		1150
Springfield Avia. Co., Munic. Arpt., Springfield, Illinois	Tandem Tr. Frnkln. 60	303 hr.	No	1150
Lexington Fly. Serv., Inc., Lexington, Ky.	Chief Frnkln. 50	281 hr.	Topped	1100
Art Whitaker, Swan Island Arpt., Portland, Oregon	Trainer Lyc. 65	700 hr.	500 hr.	1075
Northern Air Service, Grand Rapids, Michigan	C65 Cont. 65	1300 hr.	231 hr.	1075
Northern Air Service, Grand Rapids Service, Grand Rapids Airport, Grand Rapids, Michigan	TL Lyc. 65	800 hr.	200 hr.	1075
United Aero Corporation, P. O. Box 222, San Antonio, Texas	65TL Lyc. 65	1355 hr.	Just	1050
O. E. Dickerhoof, Municipal Airport, Chanute, Kansas	Lyc. 65	430 hr.	12 hr.	1050
Richmond Air Transport, Byrd Arpt., Richmond, Va.	60TF Frnkln. 60	355 hr.		1000
Evan Holtzman, Royal Airport, Madison, Wisconsin	T Lyc. 65 Dual	413 hr.	30 hr.	995
Lenhart Flying Serv., Arpt., Marion, Ind.	TF Frnkln. 60	365 hr.	310 hr.	950
Midwest Flyers Lakeside Arpt., E. St. Louis, Ill.	Trainer Frnkln. 60	550 hr.	Jan. '41	950
R. D. Finefrock, Box 301, Tyler Texas	Chief '38 Cont. 50	500 hr.	Just relc.	950
Cedar Rapids Arwys., Inc., Cedar Rapids, Ia.	T Lyc. 65	850 hr.	150 hr.	900
O'Neal Aircraft Co., O'Neal Arpt., Vincennes, Ind.	La 65 Lyc. 65	1100 hr.		
United Aero Corporation, P. O. Box 222, San Antonio, Texas	60TF Frank. 60	1594 hr.	Just	900
Boulevard Airport, Inc., Roosevelt Blvd., Philadelphia, Pa.	Trainer Lyc. 55	425 hr.	Never	900
Southern Arwys. Sales Co., Munic. Arpt., Birmingham, Ala.	'38 Cont. 50	300 hr.	290 hr.	900
Aero-Ways, Inc., Municipal Airport, Cleveland, Ohio	Trainer TL Lyc. 65	456 hr.		895
Jones Fly. Serv., Sullivan Av. Arpt., Cols., O.	K Frnkln. 50	680 hr.	Fact. 150 hr.	875
Baker-Eberle Aviation Corp., Detroit City Airport, Detroit, Michigan	C Cont. 50	879 hr.	Just	850
O. E. Dickerhoof, Municipal Airport, Chanute, Kansas	Cont. 50	566 hr.	136 hr.	850
Portland Flying Serv., Inc., Municipal Airport, Portland, Maine	Chief Seaplane			$ 700
Martin and Phipps, 619 West 7th, Sioux City, Iowa	K45	550 hr.	Just	665
Boulevard Airport, Inc., Roosevelt Blvd., Philadelphia, Pa.	K 40	162 hr.	Never	650
H. G. Mayes, Box 2104, Huntington, West Va.	AT Cont. 50	1089 hr.	208 hr.	600
Aircraft Assoc., Inc., Munic. Arpt., Long Beach, Calif.	K Aeronca 40	837 hr.	59 hr. since	600
Aero-Ways, Inc., Munic. Arpt., Cleveland, O.	K Aeronca 40	328 hr.	Just relic.	600
Aero-Ways, Inc., Municipal Airport, Cleveland, Ohio	K	381 hr.		595
Pierce Flying Service, 2135 Broadway, Eureka, Calif.	C-3-36	1450 hr.	40 hr.	590
AMERICAN EAGLE				
John Ruzicka, Circus City Airport, Peru, Indiana	Kinner 100	330 hr.	30 hr.	600
ARROW SPORT				
Clinch Flying Service, Municipal Airport, North Platte, Nebraska	Ford V-8	120 hr.	Never	525
BIRD				
Florida Aero & Supply Co., Cannon-Mills Fld., Orlando, Florida	Kinner 90	1500 hr.	250 hr.	795
BLACKHAWK				
McBoyle Cub Sales, Airport, Lake Delton, Wisconsin	J5	618 hr.	None	1200
CESSNA				
E. H. Brockenbrough, Municipal Airport, Charlotte, N. C.	C-37 Warner 145	500 hr.	65 hr.	4500
Hubert & Dillon Air Serv., Box 177-S, Tacoma, Wash.	C-145 Warner 145	475 hr.	ship be'g majored	2950
CULVER				
Gaare Aviation Corp., 1285 Cleveland Avenue N., St. Paul, Minnesota	Cadet L.F.A. Frnkln. 80	163 hr.		1995
Gaare Aviation Corp., 1285 Cleveland Avenue N., St. Paul, Minnesota	Cadet LCA Cont. 74	34 hr.		1895
Bishop Flying Service, Bishop Airport, Flint, Michigan	Cadet Cont. 75	280 hr.		1750
CURTISS ROBIN				
Safair, Inc., Roosevelt Field, Mineola, New York	Chall. 185	1283 hr.	423 hr.	750
Red Bank Airport, Inc., Red Bank, N. J.	Chall. 185	575 hr.	162 hr.	650
DAVIS				
Capt. Arthur J. Davis, 1108 Civic Opera Building, Chicago, Ill.	Warner 125	137 hr.	None	900
ERCOUPE				
Sioux Skyways, Municipal Airport, Sioux Falls, S. Dak.	Cont. 65	160 hr.		2450
Brinckerhoff Flying Serv., Inc., College Park Airport, College Park, Maryland	415C Cont. 65	550 hr.	15 hr.	1800
FAIRCHILD				
H. G. Mayes, Box 2104, Huntington, West Va.	D24 Warner R145	650 hr.	150	4000
Thomas Metcalf, Toledo Mun. Arpt., Toledo, O.	24 Warner 145	356 hr.	Topped 306 hr.	3975
T. A. Colbertson, Medford, Oregon	246 Warner 145	800 hr.	350 hr.	3500
P. J. Sones Co., Haines City, Fla	Deluxe Warner 145	890 hr.	190 hr.	3250

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DEALERS	MODEL AND ENGINE		TIME	OVER-HAULED	PRICE
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E. H. Brockenbrough, Munic. Arpt., Charlotte, N. C.	24	Warner 145	350 hr.	Just	2395
John P. Hall, West Haven Arpt., West Haven, Conn.	24	Warner 145	348 hr.	Recently	1650
H. M. Barnes, Lumberton, N. C.	22-C7E	Warner 125		Just	1500
Art Whitaker, Box 3820, Portland, Ore.	24	Cirrus 100	1200 hr.	None since Major	1125
Doug Schall, Inc., 33 Clagett Rd., Hyattsville, Md.	KR34	Wright J65 185 h.p.	700 hr.	16 hr.	1050
Reliable Flying Service, P. O. Box 1303, Bristol, Conn.	KR34	Wright J65	670 hr.	Just	625
FLEET					
West Coast Aircft., L.A. Munic. Arpt., Inglewood, Calif.	2	Kinner 100		Just	1550
Granite State Airways, Manchester Arpt., Manchester, N.H.	2	Kinner 100	1300 hr.	1125 hr.	1200
White Fly. Serv., Inc., Caldwell-Wright Arpt., Caldwell, N. J.		Warner 125	1090 hr.	& 40	1095
St. Louis Flying Service, Lambert Field, Robertson, Mo.		Warner 125	801 hr.	50 hr.	695
FUNK					
Island Crop Dusting Co., Airport, Caribou, Me.	75B		150 hr.	at 130 hr.	1300
Island Crop Dusting Corp., Caribou Airport, Caribou, Maine	B 63		140 hr.	40 hr.	1000
Aero-Ways, Inc., Municipal Airport, Cleveland, Ohio			290 hr.		795
INTERSTATE CADET					
Roscoe Turner Aeronautical Corp., Indianapolis, Indiana	Cont. 65		72 hr.	Never	1875
KINNER					
Schneider Aero Serv., Chandler Fld., Fresno, Calif.	Sportwing	Kinner 125	1303 hr.	450 hr.	1105
KITTY HAWK					
John P. Hall, West Haven Airport, West Haven, Conn.	B-5	Kinner 125	1825 hr.	30 hr.	1250
LAIRD					
Johannesson Flying Service, Ltd., Stevenson Airport, Winnipeg, Canada	LC8200	Wright J5	1280 hr.	85 hr.	950
LUSCOMBE					
Aircraft Unlimited, Inc., Roosevelt Field, Mineola, N. Y.	8D-1	Cont. 75	50 hr.	Never	2900
Falcon Aircraft Corporation, Los Angeles, Municipal Airport, Inglewood, California	Silvaire	Cont. 75	160 hr.		2650
W. F. Luke, Schenectady, County Airport, Schenectady, N. Y.	8C1	Cont. 75	80 hr.	Never	2600
Aircraft Unlimited, Inc., Roosevelt Field, Mineola, N. Y.	8C-1	Cont. 75	120 hr.	Never	2600
Falcon Aircraft Corp., L. A., Mun. Airport, Inglewood, Calif.	8A	Cont. 65	270 hr.	Just Topped	2500
Falcon Aircraft Corp., L. A., Mun. Airport, Inglewood, Calif.	8C	Cont. 75	300 hr.	Never	2500
W. F. Luke, Schenectady City Arpt., Schenectady, N. Y.	Silvaire 8.C	Cont. A.75	70 hr.		2400
W. F. Luke, Schenectady, County Airport, Schenectady, N. Y.	8C1	Cont. 75	200 hr.	Never	2350
C. W. Petersean, Municipal Airport, Salina, Kansas	8A	Cont. 65	125 hr.	Never	1995
C. W. Peterson, Mun. Arpt., Salina, Kansas	8A	Cont. 65	100 hr.	Never	1950
Air Serv. Inc., Mun. Arpt., Denver, Colo.	8A	Cont. 65	84 hr.		1850
Midwest Fly. Serv., La Grange, Ill.	8A	Cont. 65 Dual	125 hr.	None	1850
W. F. Luke, Schenectady County Arpt., Schenectady, N. Y.	8A	Cont. 65	113 hr.		1800
Midwest Fly. Service, La Grange, Illinois	8A	Cont. 65	225 hr.	None	1700
J. L. Wells, 106 W. Main, Avon Park, Fla.	8A	Cont. 65	95 hr.	None	1675
Falcon Aircraft Corp., L. A. Mun. Airport, Inglewood, Calif.	8A	Cont. 65	700 hr.	200	1800
W. F. Luke, Schenectady County Airport, Schenectady, N Y.	8A	Cont. 65	200 hr.	Never	1800
Aircraft Unlimited, Inc., Roosevelt Field, Mineola, N. Y.	8B-1	Lyc. 65	80 hr.	Never	1800
Knox-Flite, Knoxville, Tenn.	8B	Lyc. 65	75 hr.	New	1800
Aircraft Sales of Mich., Municipal Airport, Detroit, M	8A-J	Cont. 65	850 hr.	50	1650
Floyd Foren Flyers, Inc., Detroit City Airport, Detroit, Mich.	8A	Cont. 65	911 hr.	355	1600
Upton & Bowen, West Memphis, Ark.	8A	Cont. 65	300 hr.	50 hr.	1600
Midwest Fly. Serv., La Grange, Illinois	8B1	Lycoming 65	150 hr.	None	1600
Massey & Ransom Flying Service, P.O. Box 416, Fort Collins, Colo.	8A	Cont. A65	1019 hr.	96 hr.	$1550
W. F. Luke, Schenectady County Arpt., Schenectady, N. Y.	8A	Cont. 65	350 hr.	50 hr.	1550
Massey and Ransom Flying Ser., Inc., P.O. Box 416, Ft. Collins, Colo.	8A	Cont. 65	1139 hr.	175 hr.	1495
Massey and Ransom Flying Ser., Inc., P.O. Box 416, Fort Collins, Colo.	8A	Cont. 65	1160 hr.	271 hr.	1450
Massey and Ransom Flying Ser., Inc., P.O. Box 416, Ft. Collins, Colo.	8A	Cont. 65	1489 hr.	344 hr.	1400
Aircraft Unlimited, Inc., Roosevelt Field, Mineola, N. Y.		Cont. 65	250 hr.	[No hr.	1400
Island Crop Dusting Corp., Caribou Airport, Caribou, Maine	8A	Cont. 65	550 hr.	350 hr.	1300
Carl Evers, 247 Park Avenue, New York, N. Y.	8B	Lyc. 65	450 hr.	Never	1250
E. H. Brockenbrough, Airport, Charlotte, N. C.		Cont.	225 hr.	None	1200
NEW STANDARD					
Boulevard Arpt., Inc., Roosevelt Boulevard, Philadelphia, Pa.		Kinner 90	1500 hr.	700 hr.	700
PIPER CUB					
E. H. Brockenbrough, Mun. Arpt., Charlotte, N. C.	J4	Cont. 65 '40	70 hr.	None	2200
Pierce Flying Service, Inc., Municipal Airport, Ft. Wayne, Ind.		Cont. 75	181 hr.	Never	1965
Seidner Flying Service, S.A.M. Airport, Bookwood Dr., Youngstown, Ohio	Coupe '41	Cont. 75	93 hr.	Never	1960
Stiles Motor Co., 260 Main St., Northport, N.Y.	Coupe J4A	Cont. 65	142 hr.	New	1900
E. H. Brockenbrough, Charlotte, N. C.		Cont. 65	65 hr.	New	1900
Piedmont Aviation, Inc., P.O. Box 1941, Winston-Salem, N. C.	Coupe	Cont. 65-Dual	46 hr.	Never	1885
L. L. Rupert, Box 446, Muskogee, Okla.	Coupe '40	Cont. 65-Dual	155 hr.		1850
Knox-Flite, Knoxville, Tenn.	Coupe	Cont. 75	75 hr.	New	1800
Lynn B. Fellison, 2811 Mulberry, St. Joseph, Mo.	J5	Cont. 75	83 hr.	New	1765
Des Moines Flying Service, Inc., Municipal Airport, Des Moines, Ia.	Cruiser	Cont. 75	150 hr.	Never	1750
Wappingers Falls Airport, Wappingers Falls, N. Y.	Cruiser	Cont. 75	20 hr.	Never	1750
J. L. Schroeder, Inc., Box 8055, Houston, Tex.	J4 '40	Cont. 65	93 hr.	None	1750
Southern Vt. Fly. Serv., Arpt., N. Springfield, Vt.	Cruiser	Cont. 75	40 hr.	New	1750
Inter City Aviation, East Boston Airport, Boston, Mass.	J 4 A	Cont. 65	175 hr.		1700
McVey Flying Service, Monmouth, Illinois	J5A	Cont. 75	305 hr.		1700
E. H. Brockenbrough, Municipal Airport, Charlotte, N. C.	Cruiser	Cont. 75	65 hr.		1700
Knox-Flite, Knoxville, Tenn.	Cruiser	Frnkln. 65	350 hr.		1700
Bishop Flying Service, Inc., Bishop Airport, Flint, Michigan	Cruiser J5A	Cont. 75	126 hr.		1700
Lane Air Service, Box 643, Albany, Ga.	Cruiser	Cont. 75	215 hr.	Never	1675
Odessa Flying Serv., Odessa, Texas.	Cruiser	Cont. A75-9	186 hr.	Just	1650
Rocky Mount Flying Service, Municipal Airport, Rocky Mount, N. C.	Cruiser J5	Cont. 75	240 hr.	None	1600
Herman L. Martin, Munic. Arpt., Walla Walla, Wash.	J4	Cont. 65	450 hr.	25 hr.	1600
Skelly's Flying Service, Greenville Airport, Greenville, Pa.	J6-C-75	Cont. 75	100 hr.	Never	1595
Racine Fly. Serv., Racine Arpt., Racine, Wisc.	J-4	Cont. 65	383 hr.	353 hr.	1575
Barr Aviation Corp., Detroit City Arpt., Detroit, Michigan	J4 Coupe	Cont. 65	175 hr.	None	1550
Southern Air Service., Memphis, Tenn.		Cont. 65	100 hr.	New	1550
McBoyle Cub Sales, Airport, Lake Delton, Wisc.	Trainer	Lyc. 65	40 hr.	Never	1500
J. E. Badger, 1780 Green Rd., South Euclid, Ohio	Coupe	Cont. A-65	118 hr.	None	1550
Seidner Flying Service, S.A.M. Airport, Youngstown, Ohio	Cruiser	J-5A	278 hr.		1550
St. Louis Flying Service, Lambert Field, Robertson, Mo.	Cruiser	Cont. 75	365 hr.	50 hr.	1500
E. H. Brockenbrough, Mun. Arpt., Charlotte, N. C.	J4 '40	Cont. 65	200 hr.	200 hr.	1500
Al Gillis Fly. Serv., 125 1st Ave., No., Great Falls, Mont.	Coupe '40	Cont. 65	350 hr.	None	1500
Desjardin Auto Serv., 24 Fairmount Ave., Worcester, Mass.	J-5	Cont. 75	100 hr.	New	1500
Des Moines Flying Service, Inc., Municipal Airport, Des Moines, Ia.	Coupe	Cont. 65	192 hr.	Never	1490
Susquehanna Air Service, Milton Airport, Milton, Pa.	J-4 Coupe	Lyc. 65	400 hr.	Never	1475
Racine Fly. Serv., Racine Arpt., Racine, Wis.	J-4	Lyc. 65	330 hr.	top 320	1475
Des Moines Flying Service, Inc., Municipal Airport, Des Moines, Ia.	Trainer	Frnkln. 65	145 hr.	Never	1450
J. L. Schroeder, Inc., Box 8055, Houston, Tex.	J3	Cont. 65	98 hr.	None	1440
Lexington Fly. Serv., Munic. Arpt., Lexington, Kentucky	J5	Cont. 75	230 hr.		1400
Reliable Fly. Serv., P.O. Box 1303, Bristol, Conn.	J-4	Cont. 65	140 hr.	30 hr. fact. maj.	1400
J. L. Schroeder, Inc., Box 8055, Houston, Tex.	J3	Frnkln. 65	142 hr.	None	1375
W. R. Franke, Shadwell, Va.	J4	Cont. 65	402 hr.	100 hr.	1350
Virginia Cub Distributors, Box 211, Farmville, Va.	J3	Lyc. 65	145 hr.		1350
Southern Vt. Fly. Serv., Arpt., Springfield, Vt.	J3L '40	Lyc. 65	162 hr.	New	1350

AUTHORIZED AIRCRAFT DEALERS

DEALERS	MODEL AND ENGINE		TIME	OVER-HAULED	PRICE
Al Gillis Flying Service, Box 1806, Great Falls, Mont.	P-J3C	Cont. 65	800 hr.	100 hr.	$1300
Al Gillis Flying Service, Box 1806, Great Falls, Mont.	J3C 65		820 hr.	180 hr.	1300
Shaw Aircraft Company, Municipal Airport, Iowa City, Ia.	J-3	Frnkln. 65	425 hr.	Never	1300
W. R. Franke, Shadwell, Va.	J4	Cont. 65	402 hr.	Never	1300
W. R. Franke, Shadwell, Va.	J3	Lyc. 65	154 hr.	Never	1300
TriCities Avia. Sch., TriCities Arpt., Endicott, N. Y.	J4 '39	Cont. 65	500 hr.		1300
Dethloff Flying Service, Willoughby, Ohio.	J-3	Lyc. 65	325 hr.	None	1295
Dethloff Flying Service, Euclid Avenue Airport, Willoughby, Ohio.	J-3	Frnkln. 65	200 hr.	None	1295
Martin and Phipps, 619 W. 7th St., Sioux City, Ia.	J-3	Frnkln. 60	110 hr.	Never	1275
J. L. Schroeder, Inc., Houston Main St. Arpt, Houston, Tex.	J-3 Trainer	Frnkln. 65	169 hr.	No	1275
Paul E. Eyster, Tri-State Airport, Angola, Ind.	J-3	Frnkln.	29 hr.		1250
Pierce Flying Service, Inc., Municipal Airport, Ft. Wayne, Ind.	Coupe	Cont. 65	754 hr.	390 hr.	1250
Southern Vt. Fly. Serv., Arpt., N. Springfield, Vt.	J3L'40	Lyc. 65	280 hr.	New	1250
John P. Hall, West Haven Airport, West Haven, Conn.	J-3L	Lyc. 65	400 hr.	Never	1250
Madison Fly. Serv., R. I., Madison, Ind.	J3L	Lyc. 65	205 hr.	No	1235
Mangen F. Warrington, Cub Fly. Serv., Selbyville, Del.	J3 '39 Dual	Cont. 55	40 hr.	No	1200
John Ruzicks, Airport, Peru, Ind.	J3	Frnkln. 65	140 hr.	No	1225
Hanover Air Service, Hanover Airport, E. Hanover, N. J.	J-5-A	Cont. 75	5 hr.	Never	1200
W. R. Franke, Shadwell, Va.	J3	Frnkln. 65	280 hr.	Never	1200
Desjardin Auto Serv., 24 Fairmount Ave., Worcester, Mass.	J-4	Cont. 65	550 hr.	400 hr.	1200
Galbraith Air Serv., Munic. Arpt., Paducah, Ky.	J3L	Lyc. 65	102 hr.	No	1195
Seidner Flying Service, S.A.M. Airport, Brookwood Dr., Youngstown, Ohio.	Coupe '40	Cont. 65	349 hr.	113 hr.	1195
Seidner Flying Service, S.A.M. Airport, Youngstown, Ohio.	Coupe	Cont. 65	349 hr.	113 hr.	1195
Paul E. Eyster, Tri-State Airport, Angola, Ind.	J-3	Frnkln. 65	125 hr.	Never	1150
Paul D. Eyster, Tri-State Airport, Angola, Ind.	J-3	Frnkln. 65	275 hr.	Never	1150
Susquehanna Air Service, Milton Airport, Milton, Pa.	J-3	Lyc. 65	110 hr.	Never	1100
W. R. Franke, Shadwell, Va.	J-3	Frnkln. 65	361 hr.	Never	1100
Aviation Serv., Inc., Box 408, Newport News, Va.	J3L	Lyc. 65	528 hr.	None	1100
Madison Fly. Serv., R. No. 1, Madison, Ind.	Coupe	Cont. 65	335 hr.	No	1100
Piedmont Aviation, Inc., Municipal Arpt., Winston-Salem, N. C.	Coupe	Cont. 65-Dual	432 hr.	112 hr.	1085
Frank Rensma, Box 441, Youngsville, Pa.	J-3	Lyc. 65	520 hr.		1050
Martin and Phipps, 619 W. 7th St., Sioux City, Ia.	J-3	Lyc. 55	450 hr.	Just	1050
Blevins Aircraft, Airport, Atlanta, Ga.	J-3	Frnkln. 65	300 hr.	Just	1050
Northern Air Service, Grand Rapids Airport, Grand Rapids, Mich.	J3L65	Lyc. 65	800 hr.	15 hr.	1050
Hanover Air Service, Hanover Airport, E. Hanover, N. J.	J-3-A	Cont. 65	7 hr.	Never	1050
Buroker-Hicks Flying Ser., Olympia Airport, Olympia, Wash.	J-3	Frnkln. 60	1126 hr.	1 hr.	1050
Des Moines Flying Serv., Municipal Arpt., Des Moines, Ia.	J3	Frnkln. 65	500 hr.	None	1050
Gerald Gallagher 4507 Marvive Ave., Drexel Hill, Pa.	J-3	Cont. 65	720 hr.	95 hr.	1050
J. L. Schroeder, Inc., Houston Main St. Arpt., Houston, Texas.	J-3	Cont. 65	596 hr.	Yes	1050
Towners Fly. Serv., Towanda Arpt., Towanda, Pennsylvania.	J-3-40	Lyc. 65	388 hr.	None	1050
Inter-City Fly.Serv., Mun. Arpt., Ft. Wayne, Ind.	J3 '40	Frnkln. 65	456 hr.		1050
Campbell Flying Service, Rolla, Mo.	Trainer	Frnkln. 65	350 hr.	30 hr.	1000
Safair, Inc., Roosevelt Field, Mineola, N. Y.	J3	Frnkln. 60	488 hr.	Never	$1000
Safair, Inc., Roosevelt Field, Mineola, N. Y.	J3	Lyc. 65	878 hr.	Never	1000
Safair Inc., Roosevelt Field, Mineola, N. Y.	J3	Lyc. 65	839 hr.	Never	1000
Safair, Inc., Roosevelt Field, Mineola, N. Y.	J3	Lyc. 65	856 hr.	203 hr.	1000
Blevins Aircraft, Airport, Atlanta, Ga.	J3	Cont. 65	600 hr.	Just	1000
Pierce Flying Service, Municipal Airport, Ft. Wayne, Ind.	J3C	Cont 65	781 hr.	83 hr.	1000
Northway Flying Service, Norton Field, Columbus, Ohio.	J3	Frnkln. 65	800 hr.	200 hr.	1000
Cedar Rapids Airways, Inc., Cedar Rapids, Ia.	J	Lyc. 65	650 hr.	100 hr.	1000
Palo Alto Arpt., Inc., Box 640 Palo Alto, Cal.		Cont. 65	1203 hr.	250 hr.	1000
Northway Flying Service, Norton Field, Columbus, Ohio.	J3	Frnkln. 65	650 hr.	125 hr.	1000
Zimmerly Brothers Air Transport, Box 266, Lewiston, Idaho.		Cont. 50	1300 hr.	90 hr.	1000
Spann Fly. Serv., Mun Arpt., Colorado Springs, Colo.	J4	Cont. 65	650 hr.	200 hr.	1000
Richmond Air Trans., Byrd Arpt., Richmond, Va.	J3	Frnkln. 60	530 hr.	215 hr.	1000
Midwest Avia. Corp., Norton Fld., Columbus, O.	Coupe	Frnkln. 60	600 hr.		1000
Stillwater Fly. Serv., Box 466, Stillwater, Okla.	J3C	Cont. A50-5	1073 hr.	N'w eng.	1000
L. L. Rupert, Box 446, Muskogee, Okla.	J3F '40	Frnkln. 50	150 hr.	like new	1000
W. Va. Air Service, Inc., County Airport, Clarksburg, W. Va.		Lyc. 65	1050 hr.	Just	995
Maheux's Airport, Inc., Auburn, Me.	J3-F65	Frnkln 65	900 hr.	Never	995
Carpenter Air Service, 1343 N. Lorraine, Wichita, Kansas.	J3	Lyc. 65	1175 hr.	Just	995
Carpenter Air Service, 217 S. Popular, Wichita, Kansas.	J-3	Lyc. 65	1190 hr.	Just	995
Midwest Flyers, Lakeside Arpt., E. St. Louis, Ill.	J3F	Frnkln. 60	350 hr.	None	995
Mid-Western Avia. Co., 406 Kirkpatrick Bldg., St. Joseph, Mo.	J-3	Frnkln. 50	1230 hr.	Just	985
Susquehanna Air Serv., Milton Airport, Milton, Pa.	J3	Lyc. 65	350 hr.	Never	975
Ben C. Arquitt, Mun. Arpt., Lima, Ohio.	J3	Frnkln. 60	314 hr.	272 hr.	970
W. Arnet Speer 3330 Barnett, San Diego, Calif.	J3C	Cont. 50	1950 hr.	2 hr.	950
Buroker-Hicks Flying Service, Olympia Airport, Olympia, Wash.	J3	Frnkln. 50	1345 hr.	50 hr.	950
Consolidated Air Serv., Rubinkam Arpt., Harvey, Illinois.	J3	Frnkln. 60	570 hr.	None	950
Herman L. Martin, Mun. Arpt., Walla Walla, Wash.	J3	Frnkln. 50	1100 hr.	50 hr.	950
Ray Wilson, Inc., Park Hill Arpt., Denver, Colo.	J-3	Frnkln. 50	850 hr.	mjr. 750 hrs.	950
G. L. Williams, Syracuse Arpt., Syracuse, N.Y.	J3	Frnkln. 60	998 hr.	Recent	925
Hanover Air Service, Hanover Airport, East Hanover, N. J.	J3L	Lyc. 55	5 hr.	Never	900
Skelly's Flying Service, Greenville Airport, Greenville, Pa.	J3L65	Lyc. 65	800 hr.	Just	900
Rocky Mount Flying Service, Municipal Airport, Rocky Mount, N. C.	J3F	Frnkln. 55	600 hr.	40 hr.	900
Rocky Mount Flying Service, Municipal Airport, Rocky Mount, N. C.	J-3	Frnkln. 55	550 hr.	25 hr.	900
Jersey Flying Service, Inc., Franklin Rd., Oakland, N. J.	J-3	Frnkln. 60	550 hr.	500 hr.	900
Russ Walling, Walling-Watertown Arpt., Watertown, N. Y.	J3	Frnkln. 50	925 hr.	500 hr.	900
Avia. Serv., Inc., Box 408, Newport News, Va.	J3L	Lyc. 55	550 hr.	None	900
Consolidated Air Serv., Rubinkam Arpt., Harvey, Illinois.	J3	Frnkln. 60	720 hr.	None	900
Desjardin Auto Serv., 24 Fairmount Ave., Worcester, Mass.	J-3	Lyc. 55	900 hr.	700 hr.	900
Southern Air Serv., Memphis, Tenn.		Lyc. 50	300 hr.	New	900
H. M. Barnes, Lumberton, N. C.	J3	Lyc. 65		Just	895
McBoyle Cub Sales, Arpt., Lake Delton, Wis.	Trainer	Frnkln. 50	630 hr.	130 hr.	895
Piedmont Aviation, Inc., Box 1941, Winston-Salem, N. C.	Trainer	Lyc. 65-Dual	842 hr.	348 hr.	895
Bennett Air Serv., P.O. Box 247, Hightstown, N.J.	J3	Frnkln. 50	261 hr.	Just	895

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FLYING and POPULAR AVIATION USED PLANE LISTING OF

DEALERS	MODEL AND ENGINE		TIME	OVER-HAULED	PRICE
White Fly. Serv., Inc., Caldwell Wright Arpt., Caldwell, N. J.	J3	Lyc. 50	1201 hr.	1/41 hr.	$875
Lexington Fly. Serv., Inc., Lexington Arpt., Lexington, Ky.	J-3	Lyc. 55	1050 hr.	1000 hr.	875
Southern Arwys. Sales Co. Munic. Arpt., Birmingham, Alabama	J-3	Frnkln. 50	450 hr.	425 hr.	875
Mountain States Aviation, Inc., 3800 Dahlia St., Denver, Colo.		Cont. 65	1350 hr.	400 hr.	850
Alabama Air Service, Auburn-Opelika Airport, Auburn, Ala.	Trainer	Lyc. 65	691 hr.	691 hr.	850
West Coast Arcft., L.A. Munic. Arpt., Inglewood, Calif.	J3	Frnkln. 50	590 hr.	460 hr.	850
Krantz Aeron. Serv., Port Erie Arpt., Erie, Pa.	J3	Frnkln. 50	950 hr.	No time since maj.	850
White Fly. Serv., Inc., Caldwell Wright Arpt., Caldwell, N. J.	J3	Lyc. 50	1275 hr.	8/40	850
Alabama Air Serv.,Auburn Arpt.,Auburn, Ala.	J3L	Lyc. 55	900 hr.	9/40	850
Midwest Avia. Corp., Norton Fld., Col., O.	J3F	Frnkln. 50	1080 hr.	2/41	850
Hawthorne Flying Service, Municipal Airport, Charleston, S. C.	J3	Frnkln. 60	1042 hr.	Never	825
Hawthorne Flying Service, Municipal Airport, Charleston, S. C.	J3	Frnkln. 60	1151 hr.	Never	825
Frank Rensma, Box 441, Youngsville, Pa.	J3	Frnkln. 50	775 hr.	700 hr.	800
James S. Campbell, Rolla, Mo.	Trainer	Frnkln. 50	600 hr.	Just	800
Avia. Serv., Inc., Box 408, Newport News, Va.	J3L	Lyc. 50	825 hr.	650 hr.	800
Jersey Flying Service, Inc., Oakland, N. J.	J3	Frnkln. 60	600 hr.	100 hr.	795
Fayette Arwys., Inc., Uniontown, Pa.	J-3	Lyc. 50	900 hr.	12/40	785
Smith Fly. Serv., Wilkes-Barre Wyoming Valley Arpt., Forty-Fort, Pa.	J-3	Cont. 50	1230 hr.	870 hr.	775
Alabama Air Serv., Auburn Arpt., Auburn, Ala.	J-3	Frnkln. 50	725 hr.	550 hr.	775
Jones Fly. Serv., Sullivant Ave. Arpt., Columbus, Ohio	J-3	Frnkln. 50	1500 hr.	No time since fac.	775
Skelly's Flying Service, Greenville Airport, Greenville, Pa.	J3L50	Lyc. 50	1000 hr.	Just	775
Inter-City Flying Service, Inc., Municipal Airport, Ft. Wayne, Ind.	J3-5	Frnkln. 50	600 hr.	250 hr.	775
Alabama Air Service, Auburn-Opelika Airport, Auburn, Ala.	Trainer	Lyc. 55	1489 hr.	400 hr.	775
Regan Flying Service, Shawnee, Okla.	J3	Frnkln.	766 hr.	165 hr.	750
Southern Airways, Municipal Arpt., Birmingham, Ala.	J-3	Lyc. 55	1200 hr.	None	750
Southern Arwys., Munic. Arpt., Birmingham, Ala.	J-3	Lyc. 55	1000 hr.	1000 hr.	750
Skelly's Fly. Serv., Greenville Arpt., Greenville, Pa.	J-3	Lyc. 50	1100 hr.	Maj. Only	745
Hawthorne Flying Service, Municipal Airport, Charleston, S. C.	J3	Frnkln. 50	1214 hr.	Topped	725
Jenkins Air Serv., Mun. Arpt., Rochester, N. Y.	J3 Trainer	Lyc. 50	1080 hr.	890 hr.	725
Island Crop Dusting Corp., Caribou Airport, Caribou, Me.	J3	Frnkln. 50	1400 hr.	700 hr.	700
Buroker-Hicks Flying Service, Olympia Airport, Olympia, Wash.	J2	Cont. 40	1359 hr.	Never	700
Avia. Sales, Box 408, Newport News, Va.	J3L	Lyc. 50	1100 hr.	675 hr.	700
Midwest Avia. Corp., Norton Fld., Col., O.	J3F	Frnkln. 50	1068 hr.	2/41	700
Wallace Aircraft Co., Clarcona, Fla.	J2	Cont. 40	700 hr.	May '41	695
Johnny Haralson, Air Trans. & Sales Co., Toney Field, Pine Bluff, Ark.	J-3	Cont. A-44	650 hr.	600 hr.	695
Oakland Arcft., Alameda, Calif.	J-2	Cont. 40	1785 hr.	May '40	665
Shaw Aircraft Co., Mun. Airpt., Iowa City, Ia.	J3	Cont. 40	430 hr.	Never	650
Martin and Phipps, 619 W. 7th St., Sioux City, Iowa	Ja	Cont. 40		Just & Recov.	650
J. L. Schraeder, Inc., Houston Main St. Arpt., Houston, Texas	J-2 '36 Trainer	Cont. 40	647 hr.	Yes	650
Krantz Aeron. Serv., Port Erie Arpt., Erie, Pa.	J3	Cont. 40	750 hr.	30 hr. since	650
Lane Air Service, Albany, Ga.	J-2	Cont. 40	620 hr.	Just	625
Pierce Flying Service, 2135 Broadway, Eureka, Calif.	J2	Cont. A-40	2050 hr.	110 hr.	600
H. G. Mayes, Box 2104, Huntington, W. Va.	J3	Cont. 50	780 hr.	243 hr.	600
Decatur Avia. Co., 776 S. Maffit St., Decatur, Illinois	J3C	Cont. 40	589 hr.	25 hr.	595
Seidner Fly. Serv., S.A.M. Arpt., Youngstown, Ohio	J-2	Cont. 40	396 hr.	90 hr.	579
Piedmont Avia., Munic. Arpt., Winston-Salem, N. C.	J-3	Cont. 40	516 hr.	201 hr.	575
John Ruzicka, Circus City Arpt., Peru, Indiana.	J2	Cont. 40	550 hr.	50 hr.	575
Al Gillis Flying Service, Box 1806, Great Falls, Mont.	J2-40		900 hr.	4 hr.	550
J. E. Badger, 1780 Green Rd., So. Euclid, O.	J2	Cont. 40	400 hr.	400 hr.	550
Lexington Fly. Serv., Mun. Arpt., Lexington, Ky.	J-2	Cont. A-40-5	825 hr.		550
Phillips Fly. Serv., Arpt., Mt. Pleasant, Mich.	J-2	Cont. 40	250 hr.		550
Piedmont Avia., Inc., Munic. Arpt., Winston-Salem, N. C.	J-2	Cont. 40	574 hr.	100 hr.	525
PITCAIRN					
Boulevard Airport, Inc., Roosevelt Boulevard, Philadelphia, Pa.	J67-240	Wright	345 hr.	Never	1695
John Ruzicka, Circus City Arpt., Peru, Indiana.	P6	Wright 225	1200 hr.	50 hr.	1195
PORTERFIELD					
Aircraft Sales of Mich., Municipal Airport, Detroit, Mich.		LeBlond 70	465 hr.	200 hr.	875
Kenneth V. Benesh, Monticello, Ia.	35-70	LeBlond 70	700 hr.	300 hr.	$ 695
Inter-City Flying Service, Inc., Municipal Airport, Ft. Wayne, Ind.		LeBlond	630 hr.	300 hr.	675
REARWIN					
Aircraft Sales of Mich., Municipal Airport, Detroit, Michigan	Cloudster	KR 120	New	Never	5500
Aircraft Sales of Michigan, Detroit City Airport, Detroit, Michigan	Cloudster	KR 120	New	Never	4995
C. W. Peterson, Mun. Arpt., Salina, Kansas.	Cloudster	KR 120	300 hr.	Topped 270 hr.	3200
Al Gillis Flying Service, Box 1806, Great Falls, Montana	Cloudster	KR 120	230 hr.	20 hr.	2900
Aircraft Sales of Mich., Municipal Airport, Detroit, Michigan	Skyranger	Frnkln. 80	New	Never	2845
Aircraft Sales of Michigan, Municipal Airport, Detroit, Michigan	Skyranger	Cont. 75	New	Never	2575
Aircraft Sales of Michigan, Detroit City Airport, Detroit, Michigan	Skyranger	Cont. 75	New	Never	2575
C. Evers, 247 Park Av., N. Y. C.		Warner 90	138 hr.	None	2250
Aero Sales Corp., 1008 First Nat'l Blad., Birmingham, Ala.	Skyranger	Frnkln. 80	30 hr.	Never	2200
Paris Fly. Serv., Mun. Arpt., Paris, Texas.	Skyranger	Cont. 75	125 hr.		2100
M. H. Wall, P.O. Box 327, Willoughby, O.	Skyranger	Cont. 75	35 hr.		1935
Dewey Eldred Fly. Serv., Inc., Willoughby, O.	Skyranger	Cont. 75	40 hr.		1845
M. H. Wall, 1075 East 286th St., Wickliffe, O.	Skyranger	Cont. 75	45 hr.	45 hr.	1785
Aircraft Sales of Michigan, Municipal Airport, Detroit, Michigan	Sportster	LeBlond 70	170 hr.	Never	1500
N. L. Wallingford, 401 Ingalls, Cincinnati, O.	7000	LeBlond 70	400 hr.	80 hr.	1200
Jennings Bros., No. Grafton, Mass.		LeBlond 70	680 hr.	50 hr.	1075
E. W. Wiggins Airways, Inc., Boston, Met. Arpt., Norwood, Mass.	8500	LeBlond 85	802 hr.	111 hr.	975
Southern Arwys. of Danville, Box 205, Danville, Va.	1936	LeBlond 85	368 hr.	Never	975
Racine Fly. Serv., Racine Arpt., Racine, Wis.	7000	LeBlond 70	536 hr.	510 hr.	850
RYAN					
Standard Fly. Serv., Inc., Somerset Hills Arpt., Basking Ridge, N. J.	STA	Menasco 125	190 hr.	150 hr.	3450
W. R. Franke, Shadwell Va.	STA	Menasco 125	700 hr.	100 hr.	3000
SIKORSKY					
E. W. Wiggins Airways, Inc., Boston Municipal Airport, E. Boston, Mass.	S-39	P&W 400	1349 hr.	239 hr.	4500
STANDARD					
Becker Arcft. Sales, Bettis Arpt., Homestead, Pa.	D-25	J-5-225	500 hr.	150 hr.	1500
A. A. Knowles, Rt. 4, Boise, Ida.	New	Wright J 5 220	417 hr.	3/40	1000
STEARMAN					
Stinson Fly. Corp., San Francisco Mun. Arpt., S. San Francisco, Calif.	Hammond	Menasco 150	500 hr.	10/40	1500
Tacoma Fly. Service, Box 157, So. Tacoma, Wash.	C-3-B	Wright J-5 220	1800 hr.	Recently	800
STINSON					
Hyannis Arpt. Corp., Box 592, Hyannis, Mass.	Reliant	Lyc. 245	388 hr.	2/41	6000
Thomas Oakes, 240 Belleville Ave., Bloomfield, N. J.	SR9BD	Lyc. 245	620 hr.	350 hr.	4500
Howard A. Morey, Box 529, Madison, Wisc.	SR5	Lyc. 245	947 hr.	443 hr.	4000
W. Va. Air Service, Inc., County Airport, Clarksburg, W. Va.	Voyager	Frnkln. 90	157 hr.		3895
Leach Aircraft, Inc., Roosevelt Field, Mineola, N. Y.	Voyager	Frnkln. 90	178 hr.	Never	3850
Pete Grim, R.F.D. 4, Staunton, Va.	Voyager	Frnkln. 90	135 hr.	Never	3500
Indiana Air Serv., Inc., Bendix Fld., So. Bend, Indiana	SR-7C	Lyc. 260	1600 hr.	3/41	3500
Floyd Foren Flyers, Inc., Detroit City Airport, Detroit, Mich.	Voyager	Frnkln. 90	625 hr.	105 hr.	3400
Leech Aircraft, Inc., Roosevelt Field, Hangar F, Mineola, N. Y.	105	Cont. 80	168 hr.	Never	3300
Oak Air Serv., Inc., Bates Fld., Mobile, Ala.	Spec. 105	Cont. 80	200 hr.		3250
H. M. Barnes, Lumberton, N. C.	SR-6	Lyc.	350 hr.	50 hr.	3200
Blevens Aircraft, Airport, Atlanta, Ga.	T.	Lucn. 65	Just	Just	3000
Air Serv., Inc., Bellanca Fld., New Castle, Del.	105	Cont. 80	101 hr.	2 hr.	2950
Cincinnati Arcft. Serv., Lunken Arpt., Cincinnati, Ohio	105	Cont. 80	201 hr.	Never	2850
Oak Air Service, Bates Field, Mobile, Ala.	105	Cont. 80	215 hr.	Just	2850
Reliable Flying Service, Inc., Box 1303, Bristol, Conn.	105	Cont. 80	100 hr.		2800
Paul E. DePover, Marshall, Minn.	105	Cont. 80	80 hr.		2600
Jenkins Air Serv., Inc., Mun. Arpt., Rochester, N. Y.	105	Cont. 80	215 hr.		2550
Detroit School of Aviation, Joy Airport, Fraser, Michigan	105	Cont. 80	145 hr.		2500

AUTHORIZED AIRCRAFT DEALERS

DEALERS	MODEL AND ENGINE	TIME	OVER-HAULED	PRICE
Moline Fly. Serv., Mun. Arpt., Moline, Illinois.	SR-5A Lyc. 245	850 hr.	760 hr.	$2495
Boulevard Airport, Inc., Roosevelt Boulevard, Philadelphia, Pa.	105 Cont. 80	605 hr.	130 hr.	2450
Stinson Flying Company, Alameda Airport, Alameda, California	105 Cont. 80	350 hr.	New Aug. '40	2450
G & G Airlines Co., Ltd., P.O. Box 4187, University Sta., Tucson, Ariz.	105 Cont. 80	398 hr.	170 hr.	2250
Joseph Harrell, P.O. Box 202, Eugene, Ore.	105 Cont. A-80	469 hr.	130 hr.	2200
Hood Air-Craft Sales Co., Box 171, Northampton, Mass.	SR5E Lyc. 225	545 hr.	100 hr.	2195
Colo. Avia. Co., 426 U.S. Nat'l B.B., Denver, Colo.	105 Cont. 175	400 hr.	Yes	2150
Upton & Bowen, West Memphis, Ark.	105 Cont. 75	275 hr.	5 hr.	2000
D. A. Furlong, Box 181, Clarion, Pa.	105 Cont. 75	400 hr.		1950
Narragansett Avia. Serv., R. I. State Arpt., Hillsgrove, R. I.	SR 5 Lyc. 225	1350 hr.	10 hr.	1900
Leech Aircraft, Inc., Roosevelt Field, Hanger F, Mineola, N. Y.	105 Cont. 75	790 hr.	180 hr.	1750
Becker Aircraft Sales, Bettis, Arpt., Homestead, Pa.	SR Lyc. 225	600 hr.	50 hr.	1350
Akron Airways, Arpt., Akron, Ohio.	SR Lyc.	850 hr.	350 hr.	1350
Aircraft Sales of Michigan, Detroit City Airport, Detroit, Mich.	R Lyc. 215	1000 hr.	90 hr.	1195
Lane Aviation Service, Port Columbus, Columbus, Ohio.	Lyc.	937 hr.	50 hr.	1100
Springfield Avia. Co., Munic. Arpt., Springfield, Illinois.	SM-8A Lyc. 215	750 hr.	360 hr.	1050
Livingston Airways Corp., Chapman Fld., Waterloo, Iowa.	SM-8A Lyc. 215	930 hr.	900 hr.	1000
DuBois Avia. Assoc., Munic. Arpt., DuBois, Pa.	S Lyc. 215	1053 hr.	347 hr.	950
Floyd Foren Flyers, Inc., Detroit City Airport, Detroit, Mich.	SM8A Lyc. 215	1820 hr.	259 hr.	900
Flying Dutchman Air. Serv., Sometown Arpt., Phila., Pa.	SM-8A Lyc. 220	1474 hr.	30 hr.	875
E. H. Brockenbrough, Munic. Arpt., Charlotte, N. C.	SM-8A Lyc. 215	850 hr.	820 hr.	800
Becker Arcft. Sales, Bettis Arpt., Homestead, Pa.	SM-8A Lyc. 215	700 hr.		700
Piedmont Aviation, Inc., Box 1941, Winston-Salem, N. C.	SM-8A Lyc. 215	720 hr.	412 hr.	675
Leeward Avia., New Kensington, Pa.	SM-2 Warner 125	550 hr.	Yes	500
TAYLORCRAFT				
Clarence E. Dufort, 57 Ft. Covington, Malone, N. Y.	Cont. 65	26 hr.	Never	2100
Clarence E. Dufort, 57 Ft. Covington, Malone, N. Y.	Cont. 65	42 hr.	42 hr.	2000
G. A. Short, Walnut, Illinois.	BC 12-65 Cont. 65	75 hr.	Never	1925
Lynchburg Air Transport and Sales, Preston Glenn Airport, Lynchburg, Va.	Cont. 65	225 hr.	Top-20	1850
Inter-City Flying Service, Municipal Airport, Ft. Wayne, Ind.	'41 Deluxe Cont. 65	100 hr.	Never	1850
Inter-City Flying Service, Inc., Municipal Airport, Ft. Wayne, Ind.	'41 Deluxe Cont. 65	150 hr.	Never	1850
Clarence E. Dufort, 57 Ft. Covington, Malone, N. Y.	Lyc. 65	67 hr.	Never	1825
Geo. A. Short, Walnut, Illinois.	Deluxe BC 12 Cont. 65	115 hr.	Never	1825
Hubert & Dillon Air Serv., Box 177-S, Tacoma, Wash.	BL Del. Lyc. 65 dual	200 hr.		1825
Inter-City Flying Service, Municipal Airport, Ft. Wayne, Ind.	1941 Deluxe Cont. 65	290 hr.	Never	1800
West Coast Arcft., L. A. Munic. Arpt., Inglewood, Calif.	Silvercraft Lyc. 65	53 hr.	New	1795
Taylorcraft Aviation Corp., Alliance, Ohio.	Lyc. 65-dual	140 hr.	20 hr.	1800
Jesse Jones Air Service, Municipal Airport, Lancaster, Pa.	Frnkln. 65	200 hr.	Never	1800
Inter-City Flying Service, Inc., Municipal Airport, Ft. Wayne, Ind.	Cont. 65	200 hr.	Never	1800
Inter-City Flying Service, Inc., Municipal Airport, Ft. Wayne, Ind.	Cont. 65	150 hr.	Never	1750
Wichita Falls Air Transp. Co., Box 84, Munic. Arpt., Wichita Falls, Tex.	BL-65 Lyc. 65	New	New	1750
Springfield Avia. Co., Munic. Arpt., Springfield, Ill.	BC-65 Cont. 65	195 hr.	None	1750
Inter-City Flying Service, Inc., Municipal Airport, Ft. Wayne, Ind.	Cont. 65	425 hr.	Never	1700
Tuscarawas Co. Aviation, Inc., Municipal Airport, New Philadelphia, Ohio.	BL Lyc. 65	353 hr.	Never	1695
Inter-City Flying Service, Inc., Municipal Airport, Ft. Wayne, Ind.	41 Lyc. 65	140 hr.	Never	1695
Washington Pk. Arpt., Homewood, Ill.	Cont. 65	150 hr.	None	1650
Dufort School of Aeronautics Massena Airport, Massena, N. Y.	BC Cont. 65	460 hr.	6 hr.	1650
Lynchburg Air Trans. and Sales Corp., Preston Glenn Airport, Lynchburg, Va.	Cont. 40	400 hr.	Top-160	1650
Palmyra Arpt., 817 Lincoln Ave., Palmyra, N. J.	BL Lyc. 65	138 hr.	Never	1625
Moline Fly. Serv., Munic. Arpt., Moline, Ill.	Deluxe BC Cont. 65	950 hr.	Maj.now	1600
West Coast Arcft., L. A. Munic. Arpt., Inglewood, Calif.	BC-65 Cont. 65	465 hr.	No	1595
Johannesson Flying Service, Ltd., Stevenson Airport, Winnipeg, Canada.	BL Lyc. 65	1400 hr.	480 hr.	1550
Les C. Myers, Rapid City, S. D.	BC '40 Cont. 65	165 hr.	Never	1550
Hubert & Dillon Air Serv., Box 1775, Tacoma, Wash.	BC Cont. 65	450 hr.	Motor topped	$1525
Roch. Aeron. Corp., Roch. Arpt., Roch., N. Y.	BL-65 Lyc. 65	80 hr.		1525
Walter D. Mauk, Blackwell, Okla.	Lyc. 65	400 hr.	None	1500
Fred J. Mohr, Fessenden, N. D.	Deluxe '41 Cont. 65	70 hr.	Never	1500
Narragansett Avia. Serv., R. I. State Arpt., Hillsgrove, R. I.	BL-40 Lyc. 65	254 hr.	Will be	1495
Les C. Myers, Rapid City, S. Dak.	Cont. 65	187 hr.	Never	1475
Ranger Fly. Serv., Ranger, Texas.	BL-65 Lyc. 65	140 hr.	140 hr.	1450
C. R. Galloway, 707 W. Grand, Ponca City, Okla.	Deluxe Cont. 65	600 hr.	50 hr.	1450
Rochester Aeronautical Corp., Rochester Arpt., Rochester, N. Y.	BL-65 Lyc. 65	470 hr.		1450
Hood Aircraft Sales Co., P.O. Box 164, Turners Falls, Mass.	BL-65 Lyc. 65	490 hr.	Never	1445
Clinch Flying Service, Municipal Airport, North Platte, Nebraska.	BL Delux '40 Lyc. 65	1500 hr.	275 hr.	1400
Moline Fly. Serv., Munic. Arpt., Moline, Ill.	DeLuxe BL Lyc. 65	675 hr.	None	1400
Palmyra Arpt., 817 Lincoln Ave., Palmyra, N.J.	BL Lyc. 65	318 hr.	Never	1400
Ranger Fly. Serv., Munic. Arpt., Ranger, Texas	BL-65 Lyc. 55 dual	170 hr.	170 hr.	1395
Washington Park Arpt., Inc., Homewood, Ill.	Lyc. 50	85 hr.	None	1390
Aircraft Unlimited, Inc., Roosevelt Field, Mineola, N. Y.	Lyc. 65	585 hr.	No	1350
Dawson Air Serv., Box 852, Salina, Kans.	DeLuxe BL Lyc. 65	840 hr.	Just	1350
Ranger Fly. Serv., Ranger, Texas.	BL-55 Lyc. 55	180 hr.	180 hr.	1350
Inter-City Fly., Munic. Arpt., Ft. Wayne, Ind.	BL '40 Lyc. 50	326 hr.		1325
Hood Aircraft Sales Co., Box 171, Northampton, Mass.	BL-65 Lyc. 65	400 hr.	Never	1325
Lane Avia. Serv., Pt. Columbus, Columbus, O.	Lyc. 65	428 hr.	Never	1300
Jesse Jones, Munic. Arpt., Lancaster, Pa.	Lyc. 65	300 hr.		1300
Greenville Sch. Avia., Treaty City Arpt., Greenville, Ohio.	BL Lyc. 65	265 hr.	None	1300
Hopewell Fly. Serv., Hopewell Arpt., Hopewell, Va.	BL-65 Lyc. 65	375 hr.	9/40	1300
Tuscarawas County Aviation, Inc., Munic. Arpt., New Philadelphia, Ohio.	BL Lyc. 65	1115 hr.	471 hr.	1275
Earl J. Howard, P.O. Box 565, Ames, Iowa.	BLT Lyc. 65	510 hr.	None	1200
Roscoe Turner Aeronautical Corp., Indianapolis, Ind.	BBC Cont. 65	580 hr.	Never	1250
J. E. Badger, 1780 Green Rd., S. Euclid, O.	Cont. A-65	340 hr.	Top-300	1250
Tuscarawas Co. Aviation, Inc., Munic. Arpt., New Philadelphia, Ohio.	BL Lyc. 65	1066 hr.	Just	1245
Marlboro Airport, Inc., Farm Road, Marlboro, Mass.	Cont. 50	560 hr.	60 hr.	1200
Marlboro Airport, Inc., Farm Road, Marlboro, Mass.	Trainer Lyc. 55-dual	772 hr.	142 hr.	1200
Reliable Fly. Serv., Inc., Bristol, Conn.	BL 65 Lyc. 65	864 hr.	864 hr.	1200
Dubuque Airways, Inc., Box 517, Dubuque, Ia.	BL Lyc. 65	909 hr.	250 hr.	1200
Dubuque Airways, Inc., Box 517, Dubuque, Ia.	BL Lyc. 65	418 hr.	Never	1200
Rochester Aeron. Corp., Rochester Arpt., Rochester, N. Y.	BL-55 Lyc. 55	500 hr.	None	1200
Tuscarawas County Aviation, Inc., Municipal Airport, New Philadelphia, Ohio.	BL Lyc. 65	1203 hr.	599 hr.	1195
C. W. Peterson, Munic. Arpt., Salina, Kans.	BLT-65 Lyc. 65	290 hr.	Never	1195
Boyd Mote, Denman Ave. Coshocton, Ohio.	BL-50 Lyc. 50	105 hr.	New 1940	1195
Roscoe Turner Aeronautical Corp. Indianapolis, Ind.	BC Cont. 65	590 hr.	Never	1175
Dufort Sch. Aero., 57 Ft. Covington St., Malone, N. Y.	BT Lyc. 55	395 hr.	New 5/40	1175
Clinch Flying Service, Municipal Airport, North Platte, Nebraska.	BL Lyc. 50	950 hr.	100 hr.	1150
Dufort School of Aero., Massena Airport, Massena, N. Y.	BLT Lyc. 55	618 hr.	70 hr.	1100
Dethloff Flying Service, Euclid Avenue Airport, Willoughby, Ohio.	1939 Lyc. 55	300 hr.	None	1100
Harry C. Phillips, Phillips Flying Service, Mt. Pleasant, Mich.	BLT Lyc. 50	500 hr.	Never	1100
Palmyra Arpt., 817 Lincoln Ave., Palmyra, N. J.	BLT Lyc. 50	373 hr.	83 hr.	1100
Dewey Eldred Fly. Serv., Lost Nation Arpt., Willoughby, Ohio.	BL-65 Lyc. 65	831 hr.	Ship 11/40	1100
B. F. Sponamore, 710 5th Street, Dodge City, Kansas.	Trainer Lyc. 55-dual	880 hr.	130 hr.	1050
Duane L. Huscher, Box 65, Lawton, Okla.	BF Frnkln. 50	1302 hr.	197 hr.	1050
Decatur Avia. Co., 776 S. Maffit St., Decatur, Illinois.	BL Lyc. 50	570 hr.	No	1050
Ryan Air Serv., Decorah, Iowa.	Late '39 Lyc. 50	770 hr.	350 hr. Since	1050
Wichita Falls Air. Transp. Co., Box 84, Munic. Arpt., Wichita Falls, Texas.	BLT-55 Lyc. 55	400 hr.	50 hr.	1050
Phillips Fly. Serv., Arpt., Mt. Pleasant, Mich.	BL-50 Lyc. 50	1100 hr.	900 hr.	1050
Merrill Hale, Hillsgrove, R. I.	Frnkln. 50	268 hr.	35 hr.	1050
Foster A. Lane, Port Columbus, Columbus, O.	Lyc. 65	773 hr.	225 hr.	1000
Indiana Air Serv., Bendix Fld., South Bend, Ind.	BL Lyc. 55	1038 hr.		1000
Louis A. Musgrove, Box 814, Morgantown, W. Va.	BL Lyc. 50	725 hr	150 hr.	1000
Narragansett Avia. Serv., R. I. State Arpt., Hillsgrove, R. I.	BF Frnkln. 50	351 hr.	130 hr. Since	995
Schneider Aero. Serv., Chandler Fld., Fresno, Calif.	BC Cont. 50	1216 hr.	106 hr.	950
St. Louis Flying Service, Lambert Field, Robertson, Mo.	BL50 Lyc. 50	1148 hr.	Recently	945
Johannesson Flying Service, Ltd., Stevenson Airport, Winnipeg, Canada.	A Cont. A40-3	1900 hr.	146 hr.	900

(Continued on Page 129)

Classified Advertising

RATE: 8c PER WORD FIRST 15 WORDS $1.00

AIRPLANES—SALE OR TRADE

LUSCOMBE

1940 Luscombe 8A, Cont. 65, dual ignition, brakes, tail wheel, compass, radio antenna, sound proofed, blue stripe, $1385. Arents Air Service, Inc., Westchester Airport, Armonk Village, New York.

LUSCOMBE 8A Cont. 65. New December 1940, dual ignition, brakes, parking brake, compass, tail wheel, radio antenna, $1575. Arents Air Service, Inc., Westchester Airport, Armonk Village, New York.

LUSCOMBE 8A1, Cont. 65. Factory delivered May 28, 1941, dual ignition, brakes, tail wheel, compass, 305 hours, excellent shape, price new $2270. Going for $1735. Arents Air Service, Inc., Westchester Airport, Armonk Village, New York.

DELUXE Luscombe Silvaire, NC28607—75 injection Continental—two-way radio, blind flying instruments, lights, battery, generator, parking brake, other extras. PD&L insured through March. Total time—185 hours cross-country, 25 hours since periodic overhaul and relicensing, good until October 1942. Private owner, wants $2800 cash. Address: Del Santee, 506 S. 41st St., Philadelphia, Pa.

STINSON

1941 Stinson Voyager, Franklin 90. RCA receiver, adjustable front seats, wheel pants, red and blue trim, like new, total time 200 hours. Cost $4380 new. Sell for $3945. Arents Air Service, Inc., Westchester Airport, Armonk Village, New York.

STINSON Voyager, 90 Franklin, Starter, radio receiver, navigation lights. Excellent condition. 90 hours. Box HW, % Flying and Popular Aviation, 540 N. Michigan Ave., Chicago, Illinois.

STINSON Voyager: 90 Franklin, Starter, lights, RCA receiver, yellow blue trim, perfect condition, 200 hours, $3,950.00. Clyde E. Williams, Jr., 724 Cooper Building, Denver, Colorado.

MISCELLANEOUS

FOR Sale—Used Continental, Model A-70-2, 165 H.P., Motor parts. O. Gould, 885 E. Grand Blvd., Detroit, Michigan.

J3 CUB '41, Continental 65, Tailwheel, brand new, only 8 hours delivery time. Sacrifice $1400. Lt. Altglass, Bowman Field, Louisville, Ky.

VULTEE V1A—Cyclone 775 H.P.; ten place; license No. NC-22077; perfect condition. Link Aeronautical Corporation, Binghamton, N. Y.

AIRPLANES, Motors. Crackup bargains everywhere. OX-5 planes $100.00 Up. Send 25c for complete catalogue. Used Aircraft Directory, Athens, Ohio.

LATE 1939 Aeronca Chief: Continental 65, 580 hours, just re-licensed, motor and ship perfect, nav. lights, heater, antenna, mixture control, etc. $1,250.00. Clyde E. Williams, Jr., 724 Cooper Building, Denver, Colorado.

AIRPLANES WANTED

FLEET Late Model, give details, engine, time, prop, radio, instruments, color, price. Must have extra gasoline capacity. Send pictures. Box 1102, Hilo, Hawaii, T.H.

LIGHT plane. Three place preferred. Have 1939 Buick Special to trade. Will pay some cash. R. F. Henneman, Antigo, Wisconsin.

WILL trade '38 Chev. Coupe and up to $100.00 for down payment on 50 or better light plane. All letters answered. B. G. Wheat, Van Horn, Texas.

AVIATION SUPPLIES

SCHOOL equipment hydraulic retractable gears, instruments, propellers, wings (metal), deicing equipment, quart Fyr-Fyter extinguishers, $3.98 new, engines, fuselages. Marvin Northrop Aeroplane Company, Minneapolis, Minnesota.

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LYON Aircraft Navigational Computer: Necessary for cross-country dead reckoning. Complete with book of Instructions. $3.00 postpaid or C.O.D. Quiz System, Dept. P, 1435 Flower St., Glendale, California.

NEW Tires: 8:00x4, 6:00x6, 7:00x4 two-ply $8.75, four $10.00. Tubes $3.00. Shipped C.O.D. Inspection allowed. Propellers—any size rush delivery. Bob Trader Aero Supply, Municipal Airport, Pittsburgh, Pennsylvania.

BOOKS

SIMPLIFIED Instrument Flying, Takes the headaches out of blind flying. Complete book by Capt. Creighton Mackey, only $1.00. Aircraft Directory, Athens, Ohio.

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